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COLEOPTEROCORIS, AN INTERESTING NEW GENUS OF THE SUBFAMILY POTAMOCORINAE

(Naucoridae: Heteroptera)

H. B. HUNGERFORD,[1]
University of Kansas,
Lawrence, Kansas

In 1941 Doctor Robert Usinger set up the new Subfamily Potamocorinae for *Potamocoris parvus* Hungerford, which was described in the same issue of the Annals of the Entomological Society of America, Vol. XXXIV, pp. 1–4, Plate I. This tiny species, only 2.8 mm. long, appeared to be a most interesting discovery, and remarkably smaller, and structurally different from any Naucorid known. Recently there has come to my attention another new species of about the same size, but with characters that place it in another genus and add strength to the suggestions of Doctor Usinger and Mr. W. E. China[2,3] that there is some close relationship between the Naucoridae and the Helotrephidae.

It is interesting to find the Potamocorinae, which are the most primitive of the Naucoridae, in South America, which is the home of both Paratrephes and Neotrephes which are Helotrephids, believed by Mr. China to more closely resemble the primitive proto-Helotrephidae than do any of the Old World forms. In his table showing the probable evolutionary lines of Helotrephidae, Mr. China suggests that the proto-Helotrephidae arose from the proto-Naucoridae. No doubt when there is a sufficient number of specimens of this strange

[1]Contribution of the Department of Entomology, University of Kansas.

[2]W. E. China, 1936, Annals and Magazine of Natural History, Ser. 10, Vol. XVII, pp. 537–8.

[3]W. E. China, 1940, Annals and Magazine of Natural History, Ser. 11, Vol. V, pp. 124–26, and table.

new species, a morphological study will throw some light upon the problem.

This new bug is without doubt a near relative of *Potamocoris parvus* Hungerford, and I was tempted to describe it as a new Potamocoris species. While specifically distinct we still have a question which we cannot settle, for we know *Potamocoris parvus* Hungerford from fully winged forms only, and the new species has the flight wings reduced as in most specimens of Plea, and the hemelytra are shield-like and meet in a straight line down the back without claval suture or embolium. The absence of a claval suture and a marked embolium in forms with aborted flight wings may not be of generic significance as has been shown for Helotrephes by Esaki and China[4], and for Neotrephes (Helotrephidae) by Mr. China[5]. Nevertheless, there are considerations that lead me to erect a new genus for this new insect. In the Naucoridae we have the genus Melloiella De Carlo which is separated from Ambrysus Stål by its greatly modified hemelytra, and in the Pleidae which have the hemelytra meeting in a straight line down the back, as in this new form, there is no difference in this character whether the flight wings are aborted or developed. I would expect therefore that in this new form, if flight wings are developed, the hemelytra will remain the same shape although a clavus may then be apparent.

Coleopterocoris new genus

Body moderately elongate. Head large, eyes small with coarse facets. Head set into the prothorax which embraces the lateral margins of the eyes at their base. Inner angle of eye remote from caudal margin of the head. Eyes curved over the lateral margin of the head to occupy nearly as much area beneath the head as above. Labrum transverse, set beneath the anterior margin of the head, apex rounded. Beak slender, 3-segmented, last two segments elongate. Antennae 4-segmented, slender, arising from beneath the mesal half of the caudoventral margin of the eyes. Gula long, not carinate, but broadly elevated. Pronotum with caudal margin plainly excavated in front of scutellum, which is short and transversely depressed at base. Hemelytra coreaceous, without embolium or clavus and meeting in straight line down the back. Prosternum moderately carinate. Mesosternum slightly carinate. Venter naked except for scattered hairs. All tarsi end in two claws; anterior tarsus one-segmented, others two-segmented.

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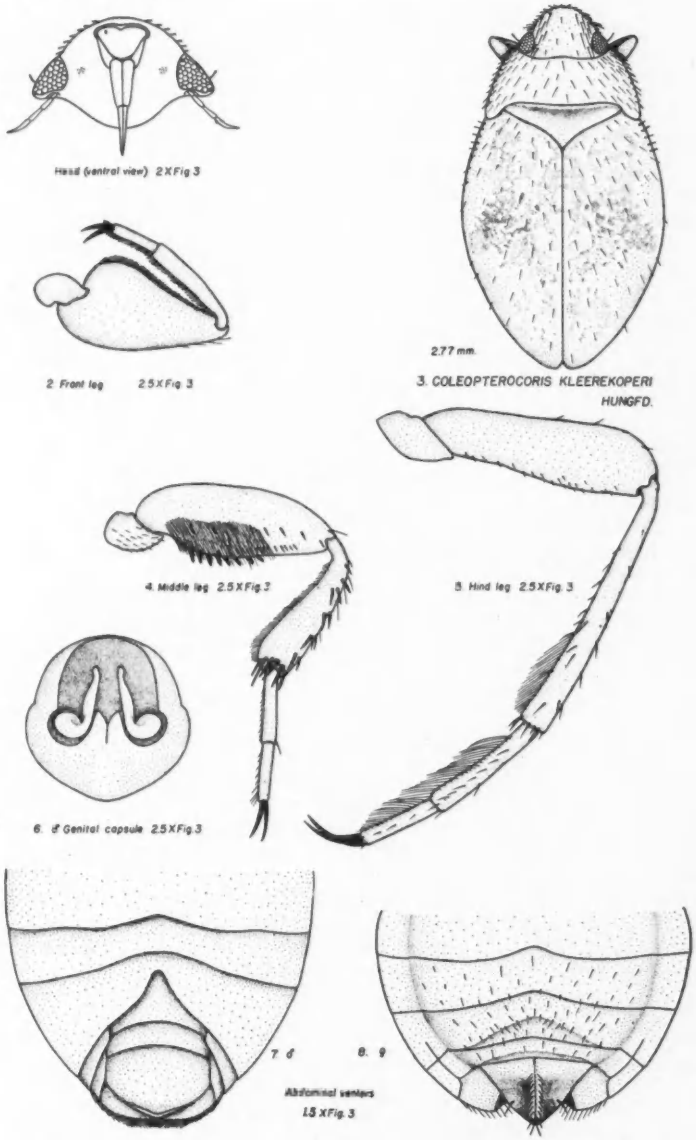
[4]T. Esaki and W. E. China, 1928; Eos Revista Espanola de Entomologia, IV, p. 135.

[5]W. E. China, 1940; Annals and Magazine of Natural History, Ser. 11, Vol. V, p. 106.



Figs. 1 to 8. *Coleopterocoris kleerekoperi*, new genus and new species, Potamocrinae: Naucoridae.

Coleopterocoris kleerekoperi n. sp.

Size.[6]—Length, 2.77 mm.; width of head across the eyes, .79 mm. Anterior width of pronotum, .8 mm.; posterior width of pronotum, 1.26 mm.; greatest width across hemelytra, 1.85 mm. Median length of head, .58 mm.; of pronotum, .42 mm.; of scutellum, .357 mm.; of hemelytral commissure, 1.76 mm.

Color.—Stramineous with brown blotches on the hemelytra as shown in the figure. Some pink areas on pronotum, scutellum, and base of hemelytra due to closely placed pink flecks. Venter and legs stramineous.

Structural characteristics.—Head smooth, pronotum and scutellum faintly, and hemelytra plainly pitted, on basal half. Dorsal surface of insect with some fine procumbent hair and a few linear scale-like hairs on head, on upper margin of pronotum, on base of embolium, and one on lateral margin of each eye. Eyes small, coarsely faceted and curved over the lateral margin of the head to occupy as much area beneath the head as above. Inner margin of the eye rounded. Interocular space about three times the diameter of an eye. Head flattened, its front broad and produced beyond the eyes by a distance about equal to their length. Labrum broader than long, apex rounded. Beak moderately slender, reaching to distal end of anterior coxae. Antennae slender arising from beneath the mesal half of the caudo-ventral margin of the eyes, and extended beneath the lateral margins of the prothorax, more than half the length of the latter. If turned laterally the last segment, and part of the third, would be exposed from above. The relative lengths of antennal segments are as follows: 1st: 2nd: 3rd: 4th::5:10: 12:17. The second segment somewhat thicker than the others.

In lateral view the head and pronotum making a declivent curve matching that of the caudal third of the hemelytra. Dorsum of the insect broadly rounded or arched (not flat). Lateral margin of pronotum rounded and broadly explanate; the anterolateral angles acute and embracing at least one third of the eyes; scutellum small and transversely depressed behind the base. The prosternum with median longitudinal carina which is produced beyond the anterior margin. Mesosternum with slight median carina. Front legs short, femora moderately incrassate. The relative length of femur : tibia : tarsus :: 8.5 : 5.2 : 2.3; middle legs short with stout spines on femur and tibia, the relative length, femur : tibia : tarsus :: 7 : 7.5 : 5.5. Hind leg with swimming hairs on tarsus and distal half of tibia, the relative lengths, femur : tibia : tarsus :: 11 : 13 : 11.3. In both middle and hind legs the first tarsal segment is slightly longer than the second. The ventral abdominal segments and the male genital capsule as shown on the plate.

Location of types.—In the Francis Huntington Snow Collection of the University of Kansas. Described from three males and one female, and labeled Holotype, Allotype, and paratypes.

[6]Measured Allotype—The overall length is measured as the insect rests on the mount. The length of head, pronotum, and scutellum are actual lengths. The hemelytral suture is measured by projection as insect rests on the mount. The Holotype is slightly smaller than the Allotype, but one of the paratypes is as large.

These four specimens and one nymph were collected by H. Kleerekoper in Brazil, South America in November, 1941; Nr. Porto Allegre.

Comparative notes.—This tiny Naucorid is undoubtedly related to *Potamocoris parvus* Hungerford, but resembles the family shape more characteristically. Like *P. parvus* it is very small, it has the slender scale like hairs, even on the eyes, its antennae and legs are much the same, and the male genital capsules are similar. It differs from *P. parvus* in having much smaller eyes, more explanate prothorax, small scutellum, hemelytra without clavus or corium, and meeting in a straight line down the back, more rounded dorsal surface, and the female abdominal venter lacks the V shaped depression so conspicuous in *P. parvus*. The nymph, which appears to be in the last instar, has the antennae three segmented, and all the tarsi are one-segmented with the swimming hairs confined to the hind tarsus. The repugnatory gland pores are on the rear margin of the third dorsal abdominal segment, and are well separated.

AUTOBIOGRAPHY OF AN OLD MAN, by W. D. FUNKHOUSER. Pages "*one*" to "sixty-four." 1941. Printed at Lexington, Ky., by the TRANSYLVANIA PRINTING CO., INC.

This is a privately printed whimsical sketch of the history of man. It is dedicated "to the memory of Tip—a mongrel, a friend of the human race and my companion for a quarter of a million years." Funkhouser for years the American authority on the Membracidae of the World is at present Dean of the Graduate School of the University of Kentucky. We first became acquainted with him while we worked at opposite sides of the same desk at Cornell. Then we learned we had been born in the same town two years apart, he the son of the Lutheran minister, the writer the son of the superintendent of schools. At Cornell we graduate students respected his thorough technique in the taxonomy of the Membracidae, admired his skill and power as a collegiate wrestler and enjoyed the dollar cigars his Cuban, Mexican and Central American students presented him as Principal of the Cornell Preparatory School (Cascadilla).

At the University of Kentucky Funkhouser found himself in a region spotted with the numerous camp sites, mounds and other remains of the Indians. Central Kentucky as discovered by Daniel Boone with its blue grass glades was probably the finest hunting ground in North America. The Indian remains indicate a rich country fought over by many tribes. These diversions drew Funkhouser from entomology for a period of years. His interest even developed to the point of an appointment as Professor of Anthropology.

The present little volume covers: 1. Old Men Dream Dreams; 2. My youth (400,000 years ago I was an Eolithic Man.); 3. The Long Trek (I was a Paleolithic Man.); 4. My Life in Africa (I was a Neolithic Man.); 5. We Migrate to Europe (I was an Explorer.); 6. Helvetia (I was an Alpine Man.); 7. America (I am a Civilized Man.). We do not know a more readable sketch of the descent of man. It is the whimsical, gracious philosophy of Funkhouser.—C. H. K.

ON THE MARRIAGE FLIGHT OF POGONOMYRMEX COMANCHE WHEELER

(Hymenoptera: Formicidae)

R. W. STRANDTMANN,
East Texas State Teachers College,
Commerce, Texas

On June 10, 1936, on the Brazos River bottom a few miles north of Waco, Texas (on Ruel Yowell's farm, to be exact), I was fortunate enough to observe the nuptial habits of the harvester ant, *Pogonomyrmex comanche* Wheeler. (Kindly identified for me by Dr. M. R. Smith of the U. S. Department of Agriculture.) They were found on a large pecan tree and so abundant that they completely covered the tree. Apparently mating occurred on the tree, or perhaps it originally occurred in the air and they settled on the tree after union.

The love life of this ant is by no means private. Each mated pair was covered by six to ten free males which by all appearances were trying desperately to dislodge the mated male and themselves copulate with the female. Through all this frenzied, chaotic scrambling of the superfluous males the female seemed interested only in maintaining a foothold on that particular part of the tree on which she happened to be. The male in copulo held on tenaciously. Clusters of these were continually dropping off and drifting to the ground, where they were so thick that I was able to pick up half a hundred specimens without moving. The scramble of the extra males went on as if nothing had happened.

To say that there were thousands of these ants would be an understatement. The pecan tree was large and its foliage was covered with ant clusters; the ground below looked as if covered with over-ripe fruit.

In three cases I dislodged all the extra males to get a better view of the mated pair. In each case the female immediately turned upon the male and chewed his abdomen until he was forced to relinquish his embrace. The female then began to preen herself. The male, however, commenced a frenzied search for his mate, but alas, when he found her she would have none of him, and she made it known in no uncertain terms. After a few rebuffs the male took wing, and the female soon followed suit. The male very likely went in search of another member of the opposite sex. Whether the female left for good or went in search of a new mate I cannot say.

THE LARVAL PILOTAXY OF CULEX PIPIENS WITH SPECIAL REFERENCE TO GENETICS[1]

THOMAS A. HART

INTRODUCTION

Much of the recent epidemiological work on human malaria and *Anopheles* has pointed to a need for more knowledge of the races of mosquitoes involved as well as of the parasites. Although much has been done in morphological, physiological, ecological, and biometric studies on the *Anopheles* mosquitoes, there have been serious drawbacks to genetic research with *Anopheles* because of their eurygamous habits; because individual selections and matings, so important in genetic work, are practically impossible; and because of the expense involved in housing them properly. In order to circumvent some of these difficulties a *Culex* mosquito was chosen for this study. *Culex pipiens* is relatively easy to maintain in the laboratory due to the existence of a stenogamous race in which individual matings after selection can be made. The particular one chosen and used throughout was a stenogamous and autogenous race. Any advances of biological significance made in the study of the species *Culex pipiens* may be related to the general problem of bird malaria. This in turn may serve as a foundation for similar observations within the field of human malaria.

This study was undertaken in order to establish a statistical base line from which comparisons among mosquito races within the species could be made. The morphological feature chosen for study was the pilotaxy of the fourth-stage larva of *Culex pipiens*, and the genetic significance of variations in a particular structure, the numbers of paired tufts on the siphon.

HISTORICAL

Since the beginning of the century there has developed in Europe and in America an interest in mosquito races—their physiological, morphological, and geographical differences. Sergent, in 1903, observed some morphological and physiological differences within the species *Anopheles maculipennis*. However, the first to suggest races within

[1]From the Department of Bacteriology and Parasitology, The University of Chicago. This research was aided by a grant from the International Health Division of the Rockefeller Foundation to the University of Chicago. The author is indebted to Prof. Clay G. Huff under whose supervision the work was done.

this species was Roubaud (1920, 1921), who observed morphological and physiological differences based on the number of maxillary teeth. He concluded that the zoophilic race possessed a greater number of maxillary teeth than did the androphilic race. Wesenburg-Lund (1921) concluded that zoophilism, caused by stall-feeding of cattle, was an environmental rather than a genetic effect. Grassi (1921) demonstrates the presence of Anophelism without malaria as developing from two races within the species (***maculipennis***) only one of which was androphilic. Further research on this subject by Missiroli and Hackett (1927) showed the presence of two definite biological races, one of which was zoophilic, the other indifferent. A later paper by Hackett (1937) reports observations on other species of *Anopheles* which show complexes within the species similar to those of *Anopheles maculipennis*.

Falleroni (1924, 1926) made the initial observations on the egg pattern of *Anopheles*. He found definite color distinctions which later showed racial cleavage into two definite forms. Based on Falleroni's studies were further observations by Hackett and Missiroli (1935) on morphological differences in egg pattern and color, on the hair arrangement of the second abdominal segment of the larvae, and on the shape of the ventral harpaginal spine of the male hypopygium. Finally Hackett (1937) demonstrated eight or nine distinct forms, in the species, based on egg pattern and color. At least seven of these races (Bates and Hackett, 1939) have been well established biometrically, genetically, and physiologically.

In studying the morphology of the adult, Van Thiel (1926, 1927) agreed with Swellengrebel (1924) as to the taxonomic importance of the long- and short-winged varieties.

The race question in *Anopheles maculipennis* is summed up by Bates (1940). He proposed that because of morphological and physiological differences the ***maculipennis*** populations be classified into species rather than races.

Shortly after work was begun on the study of races of anophelines observations on culicines were also initiated. In 1912 Neumann recorded oviposition in *Culex pipiens* without a blood meal. Huff (1929) in studying ovulation requirements for *Culex pipiens*, confirmed Neumann's earlier findings. However, a race not requiring a blood meal was not distinguished. Grassi (1923) and Legendre (1931a, 1931b, 1932) noted the occurrence of races within this species.

The first definite biological races of this species to be distinguished were those demonstrated by Roubaud and his associates in France (1929, 1930, 1930a, 1931, 1931a, 1933, 1934; Roubaud and Toumanoff 1930, 1930a; and Roubaud and Gaschen 1932). One of these races was anautogenous and eurygamous, the other was autogenous and stenogamous. Tate and Vincent (1936) investigating this problem found true biological anautogenous and autogenous races of *Culex pipiens*. By cross matings between the two races they showed the hereditary character of stenogamy and autogeny. Richards (1941) observed that *Culex pipiens* in the eastern United States shows a differentiation similar to that of the European species as regards stenogamy and autogeny.

Further study of these two races led to a description by Roubaud

(1935) of morphological differences in the egg floats. In the same year de Buck (1935), continuing the study of morphological differences, found that the number of teeth (scales) in the comb of the eighth larval segment in the typical race was greater than the number in the autogenous race.

Jobling (1936) found that the color of the autogenous adults was lighter than that of the anautogenous adults. Among the larvae he found the siphon of the autogenous race to be thicker and shorter than that of the anautogenous race; the same was true of the anal gills. The ventral brush of the autogenous race had more branches than that of the anautogenous race.

Huff (1927, 1929, 1930, 1931, 1934, 1935) showed other notable differences within this species. He found individual mosquitoes some of which proved to be susceptible, others to be refractory to bird malaria parasites. In one instance susceptibility proved to be a simple Mendelian recessive. In one experiment on color of the larvae Huff (1929) found that in the crossing of inbred strains of brown and green larvae the green was a Mendelian recessive.

MATERIALS AND METHODS

Male and female adult mosquitoes were kept in gauze-covered lantern globes over moistened cellucotton in a petri dish. Cooked raisins, placed on the gauze, served as food. Periodically canaries were secured to the top of the lantern globes to afford a blood meal for the females. On the third day thereafter these engorged females were placed over water so that they might oviposit. The eggs were removed to pans filled with distilled water. When the first larvae emerged, feeding was begun. The food consisted of a mixture of dried skim milk, yeast, and liver extract. This feeding continued through the fourth larval stage. After the larvae pupated the pupae were removed from the pans and placed in water-filled evaporating dishes under the lantern globes where the pupae became adults.

For studying the living larvae a temporary mount was made by ringing a large rectangular cover glass with paraffin, covering it with another cover glass, and placing the two of them on a slide. This method eliminated pressure on and decreased the activity of the larva which was enclosed with a drop of water inside the temporary mount.

Several methods were tried for killing and preserving the larvae to be studied for pilotaxy. The method adopted was one suggested by Hopkins (1936).

Fourth stage larvae were killed in hot 70 per cent alcohol. They were then put into fermentation tubes in a solution of lactophenol composed of 20 cc. of phenol, 20 cc. of lactic acid, 40 cc. of glycerine, and 20 cc. of distilled water. This method of preservation gave excellent definition of hairs and body structures. Since this preservative tended to soften the larvae the following method was adopted in order to eliminate pressure on the larva under observation. One large oblong cover glass was ringed with paraffin. On this ring a thin layer of vaseline was applied. A larva in a drop of lacto-phenol solution was placed within the ring. A second large oblong cover glass was used to

cover the temporary mount. This mount was then placed on a glass slide, making possible the use of a mechanical stage in observations. The vaseline which held the two cover glasses together allowed them to be turned over for observations of the dorsal and ventral surfaces of the larva.

Since the oblique position of the siphon prevented a perfectly flat view of the dorsal and ventral surfaces of the larva, it was found advantageous to observe the siphon first and then remove it before observing the head, thorax, and segments of the larva. Each larva was put back into the lactophenol solution after observations were made.

OBSERVATIONS

Pilotaxy.—Using the above method a complete study was made of the pilotaxy of one fourth-stage larva. This study included the number, length, grouping, insertion, and branchings of the hairs on the antennae, head, thorax, segments and siphon. When this study was completed, a descriptive outline and a drawing of the sample larva were made to serve as a working guide for observations on one hundred additional larvae comprising a random sample. Based on these observations and the mathematical calculations of the mode for each character studied, a modal larva was described and drawn (figures 1, 2, 3, 4, and 5).

The system used for numbering the hairs followed Martini's (1923) method for the dorsal surface. The low numbers began at the mid-dorsal line (figures 1, 2, 3, 4) and ranged upward toward the lateral edge. Martini (1923) numbered the ventral surface hairs by beginning at the lateral edge with the next number in the series and ranging upward to the mid-dorsal line. The system adopted here differs from Martini's method in the use of the same numbering scheme for the ventral and dorsal surfaces. Since the eighth segment, the anal segment, and the siphon (figure 5) are in a different plane from the rest of the animal, with the surfaces placed laterally, the numbering system does not follow the plan used on the rest of the larva. On the eighth segment the hairs are numbered consecutively from left to right. On the siphon the hairs are numbered from proximal to distal ends. The anal segment has only one numbered hair.

Martini (1923), Root (1924), and Senevet and Abonnenc (1939) drew homologies between hairs of different segments in larvae of both culicine and anopheline mosquitoes. In this study some apparent homologies have been observed. The following hairs (figures 3, 4) of the dorsal surface of segments 2 to 7 seem to be homologous: Hair number 1 appears to be homologous on segments 2 to 7. Hair number 2 and hair number 6 appear to be homologous with corresponding hairs on segments 3 to 6. Hairs number 4 and 7 seem to be homologous with the hairs of the same numbers on segments 2 to 5. On the ventral surface (figures 3, 4) hair number 3 appears homologous to the corresponding hair on segments 3 to 5. On segments 2, 3, 4, 5, and 7 hair number 4 seems homologous from segment to segment. Before these homologies can be definitely established an intensive, comparative study should be made of the various larval stages in this species and of a considerable number of series of species in the genera.

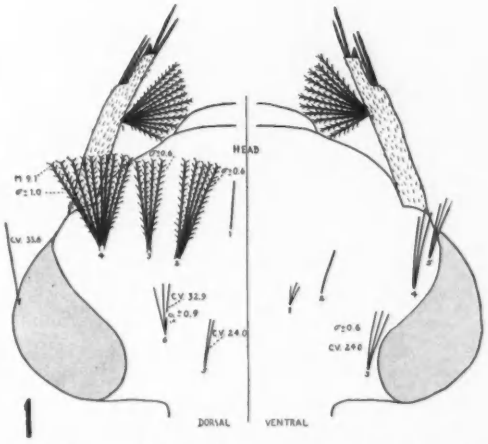


Fig. 1. Pilotaxy of *Culex pipiens* larva. Dorsal view of head.

C. V. Coefficient of variation.
σ. Standard deviation.
M. Mean.

On all the drawings (Figs. 1, 2, 3, 4, and 5) only the upper quartile figures were used for the coefficient of variation and the standard deviation. This accounts for the absence of these figures on most of the hairs. The mean was added to those hairs or hair groups in which it differed from the mode as much as 0.5 or more. The drawings express the modal arrangement of hairs. The number at the base of each hair or hair group follows the system explained in the text.

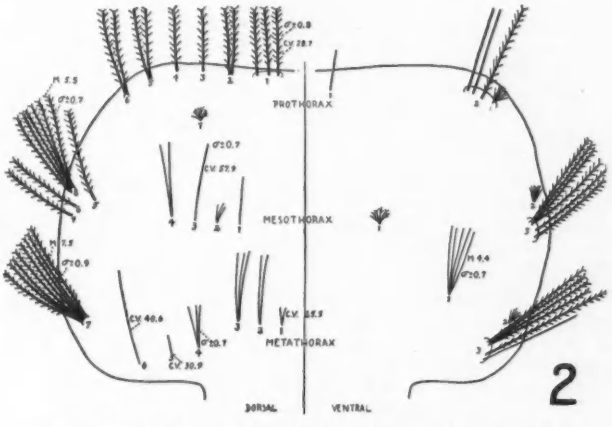


Fig. 2. Pilotaxy of *Culex pipiens*. Thorax, dorsal view.
See legend, fig. 1, for terms.

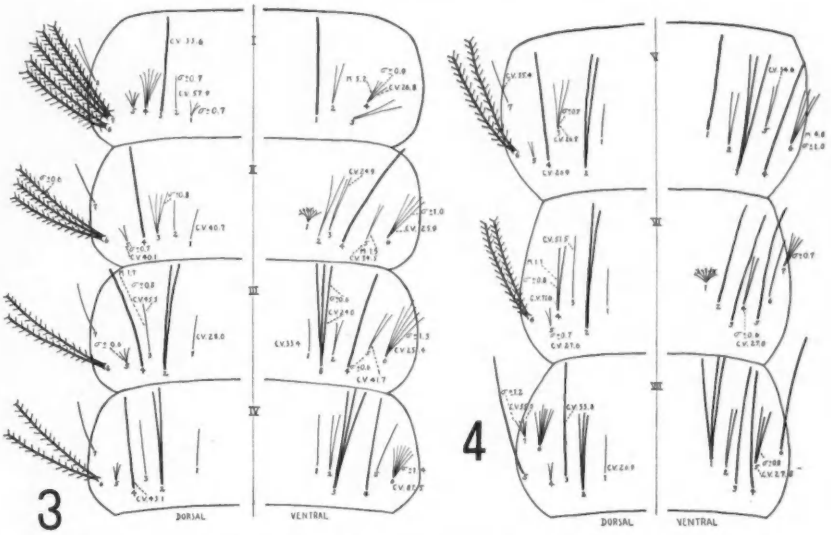


Fig. 3. Pilotaxy of *Culex pipiens*. Abdominal segments I, II, III and IV, dorsal view.
Fig. 4. Pilotaxy of *Culex pipiens*. Abdominal segments V, VI, VII and VIII, dorsal view. (See legend, fig. 1, for terms used.)

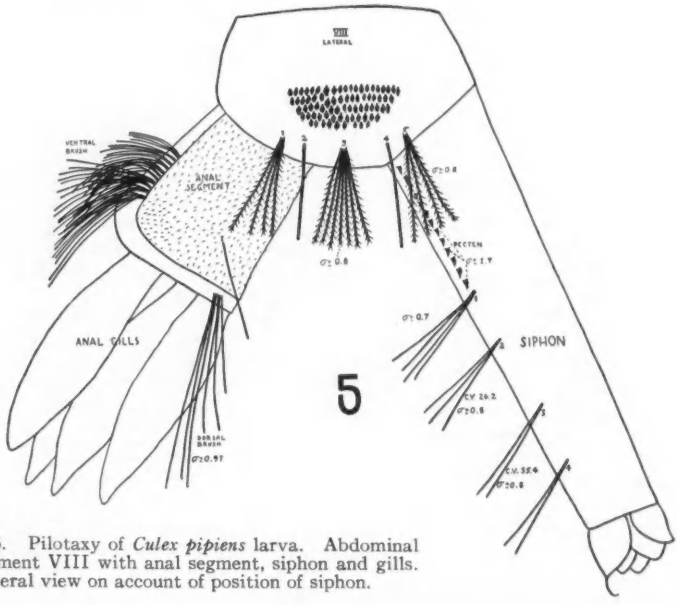


Fig. 5. Pilotaxy of *Culex pipiens* larva. Abdominal segment VIII with anal segment, siphon and gills. Lateral view on account of position of siphon.

STATISTICAL TECHNIQUES

The data from the observations were used to calculate the mean, the standard deviation, the coefficient of variation, and the standard error of the mean for each hair or hair group on the 101 larvae observed.[2] There was a total of 146 different hairs or groups of hairs on the ventral and dorsal surfaces of each larva. Since the animal is bilaterally symmetrical, a total of 292 were observed, and the calculations already mentioned were made for each individual larva. It was found that the total range for the coefficient of variation for all hairs or hair groups was from 0.0 to 87.5 per cent. The total range for the standard deviation was from 0.0 to 1.7. The range of the difference between the mode and the mean was from 0.0 to 0.9. However, on the average, the difference

TABLE I[3]

SELECTED EXAMPLES OF VALUES IN WHICH THE COEFFICIENT OF VARIATION ASSUMES AN UNUSUAL MAGNITUDE DUE TO THE LOW VALUE OF THE MEAN

Hairs	Coefficient of Variation	Standard Deviation	Mean
Dorsum of head—Hair No. 6	32.9	0.9	2.7
Dorsum of mesothorax—Hair No. 3	57.9	0.7	1.7
Dorsum of segment I—Hair No. 2	57.9	0.7	1.1
Dorsum of segment II—Hair No. 5	40.1	0.7	1.7
Dorsum of segment III—Hair No. 3	45.5	0.8	1.7
Ventrad of segment IV—Hair No. 6	87.5	1.4	1.6
Dorsum of segment VI—Hair No. 4	71.6	0.8	1.2
Dorsum of segment VII—Hair No. 7	35.0	1.2	3.6
Siphon:			
Hair No. 2	26.2	0.8	3.2
Hair No. 3	35.4	0.8	2.3

between the mode and the mean was found to be only 5.8 per cent of the mean. Only the upper quartile figures for the coefficient of variation and standard deviation were used on the drawings. In the range of differences between the mode and the mean only those differences of 0.5 or more were added to the drawings.

Since the coefficient of variation is a function of the standard deviation and the mean, it follows that if the standard deviation has a fairly fixed value while the mean changes, the coefficient of variation will change reciprocally. However, since the mean was often close to unity in this study, the changes effected in the coefficient of variation by changes in the mean were of an order greater than is usually seen in ordinary statistical computations. Therefore, while the coefficient of

[2]The complete data for all observations and calculations are being deposited with Prof. C. G. Huff, Department of Bacteriology and Parasitology, University of Chicago.

[3]The figures for this table are taken from data which are being deposited with Prof. C. G. Huff, Department of Bacteriology and Parasitology, University of Chicago.

variation is in this case the more meaningful measure of variability it must be remembered that the means encountered are often of a very low order and consequently the coefficient of variability rises to values higher than would be expected in ordinary statistical material in which the mean is more frequently higher. Table I shows selected cases from the data of this study which illustrate these facts.

COMPARISON OF THE LABORATORY STRAIN WITH A WILD POPULATION

As an initial step in the analysis of the species by biometrical studies of the pilotaxy, a comparison was made between the laboratory population and a wild population with respect to siphonal characters.

TABLE II

COMPARISON OF SIPHONAL HAIR GROUP DISTRIBUTIONS IN THE P_1 GENERATION OF THE LABORATORY STRAIN WITH THOSE OF THE WILD STRAIN

STRAIN	PERCENTAGES OF				TOTAL NO. OF LARVAE
	3 Paired Tufts	4 Paired Tufts	5 Paired Tufts	Unpaired Tufts	
Laboratory	5.2	63.7	0.0	31.0	1,649
Wild	3.0	75.0	2.0	20.0	100
Difference	2.2 ± 2.2	11.3 ± 4.8	2.0 ± .33	11.0 ± 4.6	

By examining Table II it may be seen that the three-paired tufts, the four-paired tufts, and the unpaired tufts in the two strains do not show clearly significant differences, but in the case of the five-paired tufts the difference is significant.

Observations were made on the number of pecten teeth in the same hundred fourth-stage wild *Culex pipiens* larvae. The same statistical calculations were made for these data as were made for the data on the laboratory strain. The ranges for the number of pecten teeth were from 9 to 17 in both cases. The mode was 13 for both strains. The mean for the laboratory strain was 12.8; the mean for the wild strain was 12.7. The two populations would, therefore, appear to be identical with regard to this character.

The effect of selective breeding on numbers of siphonal hair tufts.—For the selection experiment on the living larvae the siphon was chosen because it was the largest, clearest part of the larvae and the one with the simplest arrangement of hair groups. However, the variation in hair groups was not as large as in some other structures. Technical difficulties were also a factor in determining the choice of the siphon in preference to any other structure.

During previous observations on preserved specimens of *Culex pipiens* fourth-stage larvae it was found that the mode for the arrangement of hair sets on the siphon was four groups bilaterally placed. A number of larvae were found with three bilaterally placed groups of hairs. A few larvae had five bilaterally placed groups of hairs. A large number had asymmetrically arranged hair groups in various combinations, such as four on one side, three on the other; four on one side, five on the other; three on one side, five on the other; three on one side, two on the other. The bilateral arrangement of three hair groups on the siphon was chosen for the selection experiment because the four bilaterally placed groups were the modal arrangement of siphon hairs; because the asymmetrically arranged grouping of hairs was too variable, and not as subject to statistical analysis; and because the number of larvae with five bilaterally placed groups of hairs was too small.

Beginning with the W-stock strain and continuing through the P_1, F_1, F_2, and F_3 generations, selection was made of larvae having siphons with three bilaterally placed groups of hairs. A fourth-stage larva was chosen at random from the W-stock strain. It was placed in a temporary mount and observed under low power. The number of hair groups on the siphon was ascertained, and the larvae with 3 paired hair tufts were segregated. All larvae with 4 paired or unpaired tufts selected from each generation were discarded because in this experiment they were not of any genetic importance. The larvae with 3 paired tufts selected from the W-stock strain constituted the P_1 generation. As these larvae pupated they were transferred to water-filled evaporating dishes under gauze-covered lantern globes. As soon as sufficient numbers of male and female adults had emerged the females were given a blood meal. On the third day thereafter the globes containing the fed females were placed over water so that they might oviposit. The eggs thus obtained were the beginning of the F_1 generation. Each succeeding generation was similarly treated, and the same procedure used in selection of P_1 larvae from the W-stock strain was followed for the F_1, F_2, and F_3 generations. At a point in the selections on the F_3 generation isolation procedures were instituted for egg rafts for the purpose of attempting to establish a homozygous strain. Of the five egg rafts isolated, three were infertile. Selection of larvae which developed from the other two egg rafts showed a distribution of 3 paired, 4 paired, and unpaired tufts not essentially different from those of egg rafts not isolated. As the F_3 larvae pupated they were isolated in test tubes partly filled with distilled water and plugged with cotton. Upon emergence the adults were placed in pairs, one male and one female, in lantern globes. Of the several attempts to induce the females of the isolated pairs to take a blood meal, only one was successful. The eggs from this female were infertile. Isolation of adult pairs in test tubes was tried also but this proved to be no more successful than isolation in lantern globes. Attempts to feed were continued until all the isolated pairs had died. The adults which developed from these select larvae seemed to be weak. Consequently one group of adults died before another group matured. This made it impossible to build up a substantial colony in this generation.

The mass selection experiment on larvae with 3 paired tufts on the siphon began with the W-stock on March 19, 1941. The experiment was terminated August 4, 1941, with the selected inbred F_3 generation. Table III summarizes the results of the experiment.

TABLE III

RESULTS OF MASS SELECTION EXPERIMENT FOR THE THREE PAIRED TUFT CHARACTER ON THE SIPHON OF THE LARVAE

GENERATION	NUMBER OF LARVAE WITH:			TOTAL	PERCENTAGE 3 PAIRED TUFTS
	3 Paired Tufts	4 Paired Tufts	Unpaired Tufts		
P_1	86	1,051	512	1,649	5.2
F_1	150	1,122	750	2,022	7.4
F_2	116	818	576	1,510	7.7
F_3	42	75	86	203	20.7

Male mosquitoes were chosen from the P_1, F_1, F_2, and F_3 generations. These were killed, cleared, and mounted to show genitalia. Each of the males chosen at random proved to be *Culex pipiens*. These observations were made and recorded in order to be certain that the animals with which the study ended were of the same species as those used to begin the study.

DISCUSSION

The data presented in this study and the statistical analysis of these data lay a groundwork for a quantitative analysis of the species by use of clearly visible morphological characters. The statistical data described here have served to establish norms for the laboratory strain of *Culex pipiens* as regards pilotaxy. In general, these norms agree with the findings of systematic culicidologists who arrived at their conclusions through less quantitative methods. This agreement shows that the characters of the larva known to be best for species identification show a low degree of variability. Extensive examination of the pilotaxy of this species is needed. Analysis of a wide-spread species revealing valid, small differences would lead to a more complete understanding of speciation in this group of mosquitoes. The population comparisons made thus far have been in two groups separated by only 10 miles. Although these two groups were very similar in pilotaxy, it is important to note that one significant difference was found in a siphonal character.

In the selection experiment the morphological character used was found to be determined to some degree, at least, by genetic factors. The fact that susceptibility in these mosquitoes has also been established as hereditary opens up the possibility of a correlation between these two characters which might aid in the solution of the more complex problem of malarial epidemiology. Information and techniques discovered in the field of avian malaria could probably then be applied to *Anopheles* and human malaria.

SUMMARY

Observations were made on the pilotaxy of 101 prepared specimens of a stenogamous, autogenous laboratory strain of *Culex pipiens* fourth-stage larvae.

The mode, the mean, standard deviation, and coefficient of variation were calculated for each individual hair or hair group.

A selection experiment, based on siphonal hair groupings, was performed. The non-modal arrangement of three bilaterally placed hair groups was chosen. Selection and inbreeding for this character through four generations showed a continually increasing percentage. These findings indicate that the character is hereditary.

To serve as an initial attempt at an analysis of the pilotaxy of the species as a whole, a comparison was made between the laboratory population and a wild population in respect to 5 pilotaxic characters. In this study it was found that there was a significant difference in one character out of the 5 studied, even though the populations were very close together geographically.

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NOTES ON TABANIDAE (DIPT.) FROM PANAMA

VII. THE SUBGENUS NEOTABANUS AD. LUTZ[1,2]

G. B. FAIRCHILD,
Junior Medical Entomologist,
Gorgas Memorial Laboratory,
Panamá, R. de P.

Subgenus **Neotabanus** Ad. Lutz

1909, Inst. Oswaldo Cruz em Manguinhos, p. 29. (Type, designated by Bequaert.)
1924, *T. trilineatus* (Latr.). Not *Neotabanus* Ricardo, 1911.
Taeniotabanus Kröber, 1930, Dipt. Patagonia and S. Chile, Part 5, fasc. 2, p. 140. (Type, designated by Borgmeier, 1933, *T. occidentalis* L.).

Neotabanus was proposed by Adolfo Lutz in 1909 for a group of 18 Neotropical species of Tabanus. In subsequent papers (1913, 1914, 1914a, 1914b, 1922 and 1928), he defined the group by means of keys and added several species to it. Later workers have had some difficulty in deciding whether the name should be used in a generic or subgeneric sense or discarded altogether. Bequaert (1924, 1933, 1940), Enderlein (1925), Kröber (1933, 1934) and Stone (1938) have all discussed the matter to some extent. Kröber's statement (1933) that the color pattern of the abdomen is about the only character which can be used to separate the group seems to sum up the situation fairly well.

For the purposes of the present paper, the group may be characterized as follows: Eyes generally bare in the female, often hairy in the male. Frons narrow to rather broad. Third antennal segment with a dorsal tooth or angle, but without a long spine. Labella large and membranous. Subepaulet with macrotrichia, wing venation normal, but with a tendency to develop a spur vein or appendix on the upper branch of the third vein. Abdomen with markings in the form of longitudinal stripes or rows of contiguous truncated triangular spots, light on a dark ground. The color pattern of the eye in life is also quite distinctive, consisting generally of three green bands on a purple ground. In North America the group is connected with *Tabanus*, sensu stricto, by such forms as *T. vicarius*

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[2]No. VI. This journal, 34: 639–646, 1941.

Walk., *T. acutus* Big., and *T. fulvulus* Wied., while in Tropical America species such as *T. unistriatus* Hine, *T. angustivitta* Kröb. and *T. hookeri* Knab. form connecting links with other groups. In fact, it is difficult or impossible in some cases to decide whether a given species should be placed in the group or not. Thus although *T. hookeri* has a quite different eye pattern, and the abdomen is hardly striped, it is retained here for convenience, while *T. vicarius* and its allies which have striped abdomens, but eyes with but a single narrow dark band, are omitted.

Specific differentiation within the group is exceedingly difficult, as there appears to be a great deal of variation, while what differences there are seem mostly of degree. Eye characters of the male appear to offer the surest basis for separation, but this may be due to the small number of males available for study. The relative proportions of the frons, and color characters, especially of the abdomen and legs, have been the most useful in separating the females.

The nomenclature of the group is highly involved, as a great majority of the earlier descriptions are too brief to differentiate between closely allied species. The group as a whole is a dominant one, and its species generally furnish a goodly percentage of the specimens taken by any collector in the American tropics, so that nearly all the earlier dipterists described one or more species. I have been able to find 51 names which seem to apply to members of the group. Of these Kröber recognized 23 in his 1933 paper, and in 1934 listed 36, of which he claimed to have seen the types of 17. In Hine's collection there are a number of specimens labelled "comp. with Type," but for various reasons they do not help much in elucidating the tangle. Hine's other determinations for the most part do not agree with those of Kröber.

In selecting names for the Panama species, I have given priority to those names of which type material exists, or of which material determined by the author of the species exists, or on which there seems to be a general concensus of opinion. In many cases these are probably not the earliest names, but since the types of so many of the early names are lost or unrecognizable, it has seemed better to choose the moderate certainty of a possible synonym rather than the complete uncertainty of a Linnean or Fabrician name. Under each species, therefore, only those references which probably refer to the species con-

sidered are given. In addition to the Panama species, I have included a number of North and South American species of which I have material before me.

KEY TO NEOTABANUS FEMALES

1. Subcallus denuded, shiny. Frons narrow and convergent. Species small, less than 12 mm. ..... 5. (**callosus** group)
   Subcallus pollinose, or if shiny, then frons very broad. 2
2. Size small, 11 mm. or less. Subcallus always pollinose. 4
   Size larger, generally from 12 to 18 mm. 3
3. Frons from 2½ to about 3⅔ times as high as wide, the callus at least as wide as high, nearly or quite as wide as frons. Median stripe a slender line or a series of triangles. Lateral stripes very markedly step-like, 9. (**hookeri** group)
   Frons variable, generally at least 5 times as high as wide, but if wider, then the median stripe broad, nearly parallel sided and the lateral stripes at most somewhat irregular. Callus never as wide as frons. . 11. (**lineola** group)
4. Very small, about 9 mm. Frons narrow, over 5 times as high as basal width, convergent. Basal part of third antennal segment disc-like. Median abdominal stripe a series of broad triangles, laterals a series of broad patches. ..... **enanus**
   Larger, 9–11 mm. Frons broader, antennae normal, abdominal stripes well marked and rather even. ..... (See separate key) (**curtus** group)
5. Abdomen black with a uniform mid-dorsal white stripe; lateral stripes absent. Fore coxae and all femora black. ..... **unistriatus**
   Abdomen with lateral stripes. 6
6. Wings smoky. Median abdominal stripe of narrow contiguous truncate triangles, lateral stripes not step-like, but formed of a series of short streaks in line. ..... **fumatipennis**
   Wings hyaline. 7
7. Median abdominal stripe of narrow truncate triangles, lateral stripes of oval spots in line. Palpi brownish. Coxae and femora black. Abdomen dark brown. ..... **callosus**
   Median abdominal stripe uniform, parallel sided. Lateral stripes continuous, parallel sided. Abdomen brownish yellow. 8
8. Fore coxae and basal halves of mid and hind femora black. ..... **lucidecallosus**
   Fore coxae and mid and hind femora entirely reddish yellow. ..... **restrepoensis**
9. Subcallus denuded, shiny. Frons convergent. Abdomen yellowish, a small integumental black patch on the first and second tergites. Median stripe a series of triangles; lateral stripes a series of oblique patches. . **hookeri**
   Subcallus pollinose. Frons nearly parallel sided. 10
10. Coxae and femora largely black. Scutellum black. Median abdominal stripe a slender even line. ..... **johannesi**
    Coxae and femora pale. Scutellum reddish. Median abdominal stripe a series of contiguous triangles. ..... **angustivitta**
11. Median abdominal stripe of a series of narrow contiguous truncate triangles. Lateral stripes a series of oval or oblique rhomboid patches, which may or may not be contiguous. 12
    Median abdominal stripe even and parallel sided. Lateral stripes as above, or practically even and parallel sided. 16
12. Thorax striped, sometimes rather faintly so. Wings always entirely hyaline. Scutellum sometimes reddish. 13
    Thorax always unstriped. Wings variable, often faintly smoky, or costal cell yellowish, or with very faint clouds on cross-veins. 15
13. Frons nearly parallel sided, 6½ times as high as wide. Coxae and femora largely blackish. Fore tibiae not prominently bicolored, the basal half light brown, the apical half dark brown. Scutellum black. Median abdominal stripe a series of rather broad white haired truncate triangles, lateral stripes a row of unconnected, oval white haired patches which are not oblique. ..... **dunni** (Panama)

Frons rather convergent below. Fore tibiae prominently bicolored. Lateral stripes variable, but either the spots contiguous or oblique.....14

14. Scutellum black. Frons quite narrow...(North America) **lineola** var. **lineola**
Scutellum reddish. Frons quite broad..**lineola** var. **scutellaris; vittiger** var. **A.**

15. Wings with cross-veins faintly clouded. Palpi acutely pointed, (Central America) **maya**
Wings hyaline, smoky, or costal cell yellowish, cross-veins not clouded. Palpi rather blunt.....(Southern South America) **triangulum**

16. Callus over twice as high as wide with a prominent raised ridge extending from it over half way to vertex. Third antennal segment very slender, four times as long as greatest width. Thorax striped. Median abdominal stripe uniform, lateral stripes a series of unconnected oval spots which are not oblique. Size very large for the group, 18 mm., (Southern Brazil) **strigimacula**
Size seldom if ever exceeding 15 mm. Antennae never so slender. Callus broader, its dorsal extension shorter, weaker and usually unconnected....17

17. Wings hyaline. Thorax striped, sometimes faintly, scutellum blackish. Fore coxae and mid and hind femora entirely pale. Mid stripe broad, even or slightly irregular, lateral stripes irregular, both always chalky white. Whole insect grayish in tone.....**amplifrons**
Without the above combination of characters.....18

18. First antennal segment rather inflated when viewed from above. Frons not or only slightly convergent. Callus square or rounded. Costal cell often yellowish. First tergite and generally the second with a black dorsal patch. Stripes variable, the mid-stripe nearly always quite narrow, often irregular, the laterals usually step-like, never perfectly even. Fore coxae and posterior femora at base always blackish. Scutellum very rarely reddish. Color variable, yellow, red or black, **triangulum**
Without the above combination of characters.....19

19. Frons 3¾ to 4¼ times as high as wide, markedly convergent below. Frontal callus large, yellow. Scutellum reddish at apex. Fore coxae and posterior femora wholly yellow. Abdominal stripes broad, even, yellow. Whole insect yellowish brown. Wings entirely hyaline, (Central and S. America) **vittiger** var. **guatemalanus**
Without the above combination of characters.....20

20. Whole insect rather grayish, thorax striped, scutellum reddish. Frons about 4½ times as high as wide, callus black, rectangular. Fore coxae and posterior femora extensively black. Stripes white, (North America) **vittiger** var. **A.**
Without the above combination of characters, (See separate key) **lineola** and vars.

KEY TO NEOTABANUS MALES

1. At least area of enlarged facets of eye definitely pilose under a hand lens.... 2
Eye entirely bare, at most short scattered hair visible under high power magnification..... 7

2. Enlarged facets of eye much larger than small facets, occupying about ⅔ of total eye area, the line of demarkation between the two types very abrupt..... 3
Enlarged facets of eye at most only two or three times as large as small facets, occupying about ½ eye area, the line of demarkation not clearly defined..... 5

3. Frontal triangle bare and shiny. Median stripe a series of white haired triangles, lateral stripes a row of unconnected oblique spots. Fore coxae and posterior femora pale yellowish.....**hookeri**
Frontal triangle pollinose..... 4

4. Whole insect predominantly greyish. Stripes white, at least the laterals step-like. Fore coxae and posterior femora extensively dark, (Southeastern N. America) **vittiger** var. **schwardti**
Whole insect predominantly yellowish brown. Stripes yellowish, the laterals at most slightly irregular. Coxae and femora all yellowish, (Central and South America) **vittiger** var. **guatemalanus**

5. All coxae, and all femora, except extreme apices, black. Abdomen black, the median stripe a very slender line, the lateral stripes a series of oblique patches, both white haired ..... **johannesi**
   At least mid femora ⅓ pale. Abdomen not so marked 6
6. Whole insect greyish. Abdominal stripes broad and quite even, chalky white haired ..... **amplifrons**
   Whole insect predominantly brown, yellowish to nearly black. Median stripe narrow, irregular, lateral stripes oblique, step-like, both yellow to orange haired ..... **triangulum**
7. Enlarged facets of eye much larger than small, occupying about ⅔ of total eye area, the line of demarkation between the two types very abrupt 8
   Enlarged facets at most only two or three times as large as small, occupying about ½ eye area, the line of demarkation not clearly defined 9
8. Fore coxae and posterior femora wholly yellow. Abdomen yellow, brown haired, the median stripe broad and yellow, the laterals even, yellow, (Tropical America) **lineola** var. **carneus**
   Fore coxae blackish, posterior femora blackish at base. Stripes and coloration rather variable ..... (North America) **lineola** var. **lineola**
9. Fore coxae and posterior femora wholly yellow 10
   Fore coxae and at least basal ⅓ of posterior femora blackish 11
10. Size small, less than 12 mm. Thorax brown. Abdomen yellowish brown, a small dark area beneath scutellum, often extending on to second tergite. Stripes even or slightly irregular, yellow haired, intervals black haired. Legs pale brown ..... **stuppeus**
    Size larger. Whole insect greyish or brown. Thorax striped. Scutellum reddish. Abdominal stripes narrow, irregular and whitish, (North America) **lineola** var. **scutellaris**
11. At least the median abdominal stripe rather broad and even. Wings often smoky or brownish along veins 12
    Median stripe a series of contiguous triangles, lateral stripes of oblique step-like patches. Wings hyaline or with very faint clouds on crossveins .. 13
12. Abdomen yellow, black haired. The stripes rich yellow. Median stripe rather broad, laterals reduced. Legs largely yellow, (Central and South America) **lineola** var. **stenocephalus**
    Abdomen black or largely so, stripes white. Legs largely blackish, (Tropical America) **lineola** var. **plangens**
13. Abdomen with a broad mid-dorsal black stripe underlying the vestiture; sides reddish. Mid-stripe of white haired contiguous triangles, lateral stripes of oblique unconnected white haired patches. Wings entirely hyaline ..... **angustivitta**
    Abdomen yellowish with a black triangle on the first two tergites underlying the vestiture. Stripes much as in *angustivittata*, but the laterals less disconnected and oblique, all yellow haired. Wings with very faint clouds on crossveins ..... **maya**

Tabanus (Neotabanus) enanus n. sp.

(Pl. I, fig. 8)

Female—Length 9 mm., of wing 7.5 mm.

Frons about 5¼ times as high as basal width, somewhat narrower below, yellowish grey pollinose above and below, with an area of darker pollinosity about the median callus. Basal callus approximately square, as wide as frons, black, and with a wrinkled surface. Median callus spindle shaped, reaching half the distance to the vertex and unconnected with the basal callus. Vertexal tubercle absent. Subcallus pollinose. Eyes bare, green, with a median and an incomplete upper purple stripe, and the lower, outer and upper margins purple.

First antennal segment white, cap shaped and clothed with black hair; second segment scale-like. Basal part of third segment as wide as

long, almost disc shaped, yellow, the dorsal angle very obtuse. Annulate portion about as long as the basal, black. Face and cheeks greyish white, white haired. Palpi yellowish, mostly black haired, and drawn out into a slender pointed apex. Proboscis black, short, the labella fleshy and occupying nearly three-fourths the length of the proboscis.

Thorax blackish grey, grey haired, and with scattered irridescent scale-like hairs. Scutellum and antealar tubercles concolorous with the dorsum. Wings completely hyaline, the stigma yellowish. A short stump on the upper branch of the third vein. Subepaulet with macrotrichia. All coxae, all of fore femora, and basal two-thirds of mid and hind femora black. Fore tibiae half black and half yellow. Mid and hind tibiae yellow; all tarsi brown.

Abdomen black, sides of the second to fourth tergites broadly reddish. A mid-dorsal row of yellow haired contiguous triangles, and a pair of lateral step-like yellow haired stripes overlie the ground color. The posterior margins of the tergites are also yellow haired. Beneath, the abdomen is dull reddish, with a black spot on the base of the first sternite, and the terminal sternites black.

Holotype ♀, Bejuco, Panama Province, Rep. of Panama, May 21, 1940.

This is quite the smallest *Neotabanus* known to me. It shows much resemblance to some species of *Stenotabanus*, but the subepaulet is hairy, and the eye pattern is like other *Neotabanus*. The specimen was taken in an extensive patch of mangrove swamp.

Tabanus (**Neotabanus**) **curtus** Hine

(Pl. I, fig. 11)

Tabanus curtus Hine, 1920, Ohio Journ. Sci., XX, 6, p. 190. Kröber, 1934, Rev. Ent., IV, 3, p. 292 (not recognized).

I have examined the types in the Hine collection and in the Philadelphia Academy of Natural Sciences, and a topotype is

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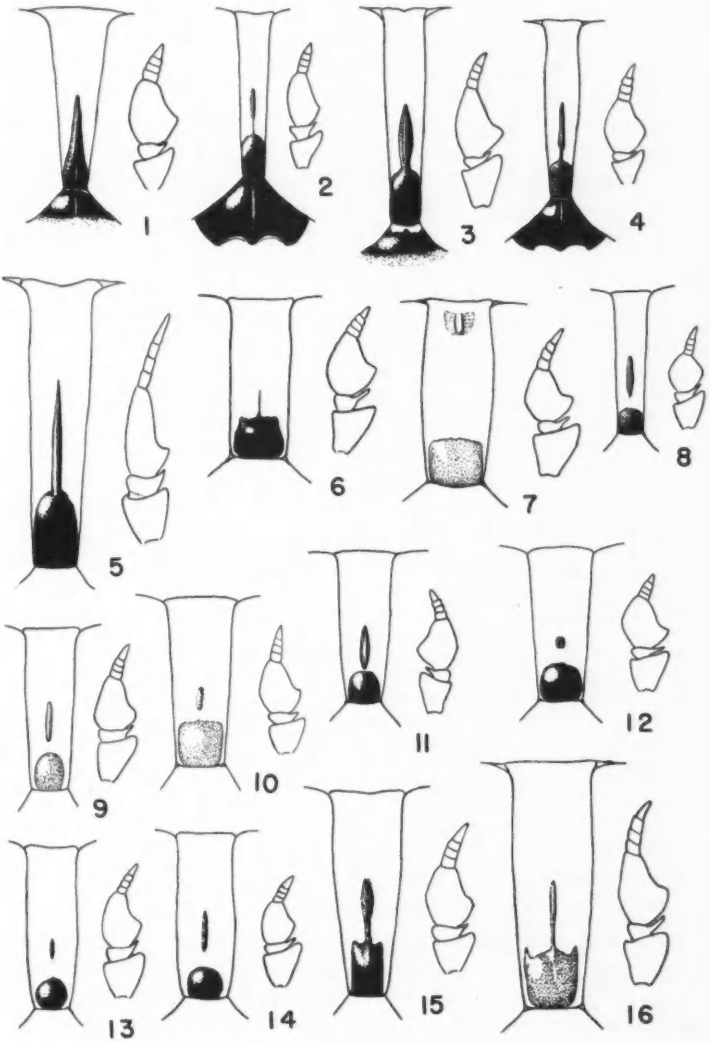
EXPLANATION OF FIGURES

All figures are of the frons and antenna of female specimens, and all are to the same scale. The vestiture of hairs on the basal antennal segments has been omitted, as it is quite uniform throughout the groups, and would only obscure the shape of the segments.

PLATE I

Fig. 1. *T.* (*N.*) *lucidecallosus* sp. nov. Holotype. Fig. 2. *T.* (*N.*) *unistriatus* Hine. Chiriqui Panama. Fig. 3. *T.* (*N.*) *fumatipennis* Krōb. Canal Zone, Panama. Fig. 4. *T.* (*N.*) *callosus* Macq. Rio Branco, Amazonas, Brasil. Fig. 5. *T.* (*N.*) *strigmaculus* sp. nov. Holotype. Fig. 6. *T.* (*N.*) *johannesi* sp. nov. Holotype. Fig. 7. *T.* (*N.*) *angustivitta* Krōb. Panama. Fig. 8. *T.* (*N.*) *enanus* sp. nov. Holotype. Fig. 9. *T.* (*N.*) "*pallidefemoratus* Krob." Panama. Fig. 10. *T.* (*N.*) *despectus* n. sp. Rio Branco, Amazonas. Fig. 11. *T.* (*N.*) *curtus* Hine. Topotype. Fig. 12. *T.* (*N.*) *dorsiger* var. *longipilosus* Krōb. Matto Grosso, Brasil. Fig. 13. *T.* (*N.*) *stuppeus* n. sp. São Paulo, Brasil. Fig. 14. *T.* (*N.*) *columbus* n. sp. Rio Solimoes, Brasil. Fig. 15. *T.* (*N.*) "*truquii* Stone." Arkansas, U. S. A. Fig. 16. *T.* (*N.*) *vittiger guatemalanus* Hine. Panama.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before me. The callus is small, rounded, yellow. Thorax and abdomen nearly black, the stripes white, the median even, the laterals slightly irregular. I have seen specimens only from the type locality, Pedernales, Venezuela.

There seem to be a considerable number of small species related to *curtus* in South America, but I have no such extensive series of them as is available for the study of the *lineola* complex, in most cases only a few specimens from one or two localities. Some of these have undoubtedly been previously described, but I have been unable to associate most of the forms before me with any published descriptions. The males of most of these forms remain unknown, which makes the problem especially difficult. A key to the forms I have been able to distinguish is here given, together with short descriptions and figures. They are given specific names with much misgiving, mainly for ease of reference. The specimens will be available, and with the accumulation of more material, the problem may eventually be solved.

KEY TO FEMALES OF CURTUS GROUP

1. Fore coxae and posterior femora blackish, wholly or in part. 2
   Fore coxae and posterior femora wholly yellowish 4
2. Only extreme bases of posterior femora dusky. First and second tergites and sternites with an integumentary black patch, otherwise yellowish brown. Stripes yellow haired, even, fairly broad. Scutellum dark. . . . **cicur**
   Posterior femora with only the apices light. 3
3. Antennal tooth obtuse, short, the basal part of third segment ½ longer than wide . . . . . **curtus**
   Antennal tooth acute, prominent, basal part of third segment about as wide as long . . . . . **dorsiger** var. **longipilosus**
4. Frons broad but convergent. Callus yellow, square, nearly as wide as frons. Scutellum reddish, abdominal stripes broad, white and even **despectus**
   Frons narrower. Callus round or square, but well separated from eye margins 5
5. Thorax brown, brown or yellowish haired. Abdominal stripes broad, even, creamy or white haired . . . . . **columbus**
   Thorax brown, brown or yellowish haired. Abdominal stripes narrow, the middle one even or irregular, the laterals generally step-like. . . . . **stuppeus**

Tabanus (Neotabanus) cicur n. sp.

Two females from Restrepo, Dept. Meta, Colombia, collected by J. Bequaert and P. C. A. Antunes. They measure just under 11 mm. In addition to the characters given in the key, the callus is black, mesonotum and scutellum blackish, brownish grey and yellow haired, wings entirely hyaline.

Tabanus (Neotabanus) dorsiger var. **longipilosus** Kröber (?)
(Pl. I, fig. 12)

Two females from Maracajú, Matto Grosso, Brasil, April–May, 1937 (Shannon and Fairchild coll.). The callus in one is reddish, black in the other. Mesonotum and scutellum blackish, grey haired. Abdomen blackish, reddish on sides. Stripes medium the median narrower than intervals, whitish, the laterals broader, even, creamy. Except for the quite even stripes, this form agrees fairly well with Kröber's (1933, p. 351) description of *T.* (*N.*) *dorsiger* var. *longipilosus*.

Tabanus (Neotabanus) despectus n. sp.
(Pl. I, fig. 10)

This is the species recorded by Bequaert (1926, p. 229), and I have seen only his specimen from Vista Alegre, Rio Branco, Amazonas, Brasil, Sept. 6, 1924. The specimen measures 10 mm.

Tabanus (Neotabanus) columbus n. sp.
(Pl. I, fig. 14)

The small callus is black or yellow, and the whole insect quite pale and grey. 1 ♀, Isla Paloma, Orinoco delta, Venezuela, Feb. 11, 1935 (N. A. Weber); 1 ♀ Caicara, Rio Solimoes, Brasil, Aug. 2, 1935 (J. Serafim); 2 ♀, ? Bahia, Brasil. Length 9–10 mm.

Tabanus stuppeus n. sp.
(Pl. I, fig. 13)

3 ♂ and 27 ♀ from various localities in the states of São Paulo, Goyaz, and Matto Grosso, Brasil. The coloration is about as in *cicur* but the coxae and femora are wholly pale. The males have bare eyes, the facets not greatly differentiated, all three abdominal stripes well marked, yellow, intervals brown haired, laterals step-like.

Tabanus (Neotabanus) dorsiger var. **pallidefemorata** Kröber (?)

Finally, I have a considerable series of females from Panama (Pl. I, fig. 9) all under 11 mm. which I am unable to separate from *lineola* var. *carneus* except by their smaller size. These may be what Kröber (1933, p. 352) calls *dorsiger* var. *pallidefemorata*, at least they agree with his description better than any other Panama material. I have also 2 males which agree well, but they are from Venezuela and Trinidad. The eyes are bare, and the facets not greatly differentiated.

Tabanus (Neotabanus) unistriatus Hine

(Pl. I, fig. 2)

Tabanus unistriatus Hine, 1906, Ohio Naturalist, VII, 2, p. 28. Kröber, 1933, Rev. Ent., III, 3, p. 365; 1934, Op. Cit., IV, 3, p. 294. Dunn, 1934, Psyche, XLI, 3, p. 174.

I have seen Hine's types, which consist of 3 females from Piedras Negras, Carillo, and San Carlos, Costa Rica (Schild coll.). There are also 3 females from Tela, Honduras, May, 1927 (Hubbel coll.) in the Hine coll. I have also seen 6 ♀ from Lancetilla, Tela, Honduras, and 1 ♀ from San Carlos, Costa Rica in Dr. Bequaert's collection.

Panama records. I have seen only a short series of the specimens taken by Dunn at Camp Pital, Chiriqui, July, 1929, and reported by him (1934).

Tabanus (Neotabanus) fumatipennis Kröber

(Pl. I, fig. 3)

Tabanus (Neotabanus) fumatipennis Kröber, 1933, Rev. Ent., III, 3, p. 341; 1934, Op. cit., IV, 3, p. 293.

Tabanus trivittatus Hine, 1906, Ohio Naturalist, VII, pp. 22, 27. (? nec. Fab. ?). Hine, 1920, Ohio Journ. Sci., XX, 6, p. 190. Bequaert, 1926, Med. Rep. Harvard Exped. Amazon, Pt. 3, p. 228.

There is a specimen in the Hine Collection labelled "*T. callosus* Macq. comp. with type," but I am inclined to accept Kröber's diagnosis in the present case. Fabricius' and Wiedemann's descriptions of *trivittatus* do not mention the bare subcallus. Bequaert (1926) gives *Tabanus primitivus* Wlk., 1848, as a synonym of this species, but Kröber (1930, Zool. Anz., LXXXVII, p. 11, fig. 10) who states that he saw the type, places Walker's species in the subgenus *Macrocormus*.

Distribution: I have seen material from the states of Amazonas and Pará, Brasil, Trinidad, British Guiana, Panama and Costa Rica.

Panama records. Cabima, May 24, 1911 (Busck coll.); Cruces Trail, Madden Highway, C. Z., July 1, 1939; Moja Pollo, May 27, June 24, 1940; Summit, C. Z., June, 1930 (Dunn); Escobal, May 4, 1931 (Dunn).

Tabanus (Neotabanus) callosus Macquart

(Pl. I, fig. 4)

Tabanus callosus Macquart, 1847, Dipt. Exot., Suppl. III, p. 11. Kröber, 1933, Rev. Ent., III, 3, p. 342; 1934, Op. cit., IV, 3, p. 292 (*Neotabanus*).

Tabanus sp. No. 1. Bequaert, 1926, Med. Rep. Harvard Exped. Amazon, Pt. 3, p. 229, fig. 7g. (Rio Branco, Amazonas.)

Kröber claims to have seen the type. Hine's specimen which he compared with the type is *fumatipennis* Kröber. The species

is very like *fumatipennis*, but the wings are entirely hyaline, and the structure of frons and antennae is quite different.

Distribution: Specimens are before me from San Alberto, Rio Branco, Amazonas, Aug. 25, 1924 (J. Bequaert), and Marajó Is., Pará, Brasil (R. Damasceno). Kröber records it from Surinam also.

Tabanus (Neotabanus) lucidecallosus sp. nov.

(Pl. I, fig. 1)

Female—Length 11 mm., of wing, 9 mm. Eyes bare, green with two purple bands and the margins purple. Frons yellowish grey, about eight times as high as basal width, and more than twice as wide at vertex as at base. Frontal callus higher than wide, brown. Subcallus shiny, yellow, not greatly inflated. The figure shows the subcallus black, but this is an error. Antennae orange, the annulate portion a little darker. Palpi white, sparsely black haired.

Mesonotum dark grey, vestiture of dark grey and shiny brassy hairs forming indistinct stripes. Scutellum concolorous. Pleura and sternum grey, with pale hairs. Coxae, all of fore femora, and basal two-thirds of mid and hind femora blackish. Fore tibiae bicolored, mid and hind tibiae and apices of femora yellow, tarsi blackish. Wings entirely hyaline; stigma narrow, yellow; no appendix on third vein.

Abdomen orange brown, blackish in the middle. Stripes even, median brassy haired, the intervals black haired. Venter orange brown, dusky along the mid-line, grey pollinose and whitish haired.

Holotype ♀, Maracajú, Matto Grosso, Brasil, April–May, 1937 (Shannon and Fairchild); Paratypes: 1 ♀, same date; 1 ♀ Cerro Pelado, Paraguay (F. Schade); 1 ♀ Villarica, Paraguay (F. Schade). To be deposited in the M. C. Z. Harvard University, Cambridge, Mass. There is also a specimen in the Hine Coll. from San Bernadino, Paraguay (Fiebrig coll.) which appears to be the same. This species differs conspicuously from *callosus* Macq. and *fumatipennis* Kröb. in the much lighter color, even, continuous abdominal stripes and much more convergent frons. Kröber's var. *brunniventris* seems to differ in having irregular lateral stripes and a different eye pattern, and seems to be correctly placed as a light form of *callosus*.

Tabanus (Neotabanus) restrepoensis sp. nov.

Female—Length 10 mm., of wing, 9 mm. Very close to *lucidecallosus*, of which it may be a local race, but differing in the following respects. Frons about seven times as high as basal width, vertex hardly one and one-half times as wide as base. Palpi less inflated basally. Mesonotum without indication of stripes. Coxae and femora wholly pale yellowish. Abdomen wholly yellow, the stripes broader, yellow haired. Otherwise as in *lucidecallosus*.

Holotype ♀ and 5 ♀ Paratypes, Restrepo, Dept. Meta, Colombia (J. Bequaert coll.). To be deposited in the M. C. Z., Harvard University, Cambridge, Mass.

Tabanus (Neotabanus) hookeri Knab

Tabanus hookeri Knab, 1915, Ins. Ins. Mens., III, 1–4, pp. 48–49 (♂, ♀; Mayaguez, Puerto Rico).
Tabanus filiolus Johnson, 1919, Bull. Amer. Mus. Nat. Hist., XLI, p. 428. Not *T. filiolus* Will. 1901.
Tabanus flavifrons Szilady, 1926, Biol. Hung., I, pt. 7, p. 22, Pl. 4, fig. 12 (♂, ♀; Cuba).
?*Tabanus refiventris* Macquart, 1838, Mem. Soc. Sci. Lille, pt. 2, p. 145 (♂; Cuba). Not *T. rufiventris* Fab. 1805, not *T. rufiventris* Macq. 1845.
Tabanus (Neotabanus) hookeri Bequaert, 1940, Rev. Ent., XI, 1–2, pp. 361–365, fig. 32. (Cuba, Jamaica, Puerto Rico, Hispaniola, Barbados, Venezuela, British Guiana, Colombia, Trinidad, Brazil, Paraguay and Argentina.)

Bequaert (l. c.) has given a thorough discussion, excellent figures, and complete synonymy of this species, which there seems no need to repeat here. The bare subcallus and broad frons will easily separate it from other members of the group. The complete absence of such a wide ranging species from Central America is very curious.

Tabanus (Neotabanus) johannesi sp. nov.

(Pl. I, fig. 6)

Female—Length 11 mm., of wing, 9 mm. Eyes bare under a hand lens, but showing sparse and very short pubescence under magnification of 32 diameters. Eyes (revived) green, the upper and lower margins purple, and with a complete median and incomplete upper purple band. Frons a little less than three times as high as wide, parallel sided, dark grey pollinose. Frontal callus black, nearly as wide as frons and wider than high. Subcallus, fronto-clypeus and genae pale grey pollinose, beard white. Palpi white, sparsely black haired. Antennae as figured, the basal segments pale yellowish, black haired, the third segment orange.

Mesonotum blackish, the vestiture black and grey, forming indistinct stripes. Scutellum black. Pleura and sternum dark grey, white haired. Coxae, all femora except extreme apices, all tarsi, and apical half of fore tibiae black. Basal half of fore tibiae white, other tibiae and apices of femora dirty yellowish. Wings entirely hyaline, stigma pale yellow.

Abdomen black above, with an even, slender, white mid-dorsal line from first to sixth tergites. Lateral stripes white, extending to sixth tergite, and formed of oblique oval patches which do not overlap. Venter black, sparsely white haired, especially on the posterior sternal margins.

Male—Eyes contiguous, pubescent, especially on the large facets. Facets but slightly differentiated in size, the larger occupying about half total eye area and poorly demarkated from the smaller. Coloration

essentially as in female, but tibiae rather brownish, including basal half of fore pair. Antennae more slender, but still unusually broad for a male of this group.

Holotype ♀, Villarica, Paraguay (F. Schade coll.). To be deposited in the M. C. Z., Harvard University, Cambridge, Mass. Allotype ♂, Severinia, São Paulo, Brasil, Dec., 1940 (A. G. Silva coll.). In the collection of the Instituto de Hygiene, São Paulo, Brasil. 1 ♀ Paratype, Agua Limpia, Brasil, March 27, 1925, in Coll. J. Bequaert.

I had at first considered this species to be *pungens* Wied., but the description of the latter states that the abdomen has the mid-stripe of broad triangular spots, and the wing veins and costal cell (Randmal) brownish. The species seems rather closely related to *hookeri* and *angustivitta* of this paper.

Tabanus (Neotabanus) angustivitta Kröber

(Pl. I, fig. 7)

Tabanus (*Neotabanus*) *dorsiger* var. *angustivitta* Kröber, 1929, Ann. Naturh. Mus. Wien, XLIII, p. 250, fig. 9. (♀; Taperinha, near Santarem, Brazil); 1933, Rev. Ent., III, 3, p. 352 (redescribed as new!); 1934, Rev. Ent., IV, 3, p. 293.

I have used Kröber's name for this species, as his description conforms the most closely to my material, but it is very probable that an earlier name for the species exists, though I have been unable to find one which entirely fits. *Pungens* Wied. 1828, is the oldest name, but Kröber, who had seen the type, places it in *Agelanius* in his catalogue (1934, p. 302). I have not seen the original description of *desertus* Walk., 1850, but the figure given by Bodkin and Cleare (1916, p. 186) certainly resembles the present form closely. Kröber did not recognize the species. Two of Bellardi's descriptions are close, but *subsimilis*, 1859, seems to have a bare subcallus and blackish femora, while *propinquus* 1859, is stated to have the vestiture yellowish. *Furunculus* Will., 1901, reads much like the present species also, but the description is not sufficiently detailed for certainty.

Distribution: In the Hine collection there is a male from Tabasco, Mexico, and a number of females from Morales and Panzos, Guatemala, labelled *sallei* Bell., and a single female (Georgetown, Brit. Guiana, Cleare coll.) labelled *comitans* Wied. I have also seen specimens from Venezuela (Caripito, July, 1937); Isla do Marajó, Pará, Brasil; and São Paulo, Brasil (Juquia, Oct. and Dec., J. Lane); Bahia, Brasil; Mendoza, Argentina; Restrepo, Colombia; Guayaquil, Ecuador; Villarica, Paraguay, and Lima, Peru.

Panama records: One of the more abundant species throughout the Republic. Moja Pollo, practically throughout the year, but less abundant in Sept. and Oct.; Darien (Dunn); El Valle, Coclé Prov., Dec., 1939; Mt. Hope, C. Z., Nov., 1939; also bred from larvae on several occasions.

Tabanus dunni n. sp.

(Pl. II, fig. 18)

Female—Length 13–14 mm., of wing, 11–12 mm. Eyes bare, the color pattern (revived) consisting of a pair of median green stripes, the upper of which is broad and invaded by a purple spur from the frontal margin. The background is purple. Frons dark grey pollinose, with a darker patch at vertex, and covered with moderately dense dark hairs, between 3½ and 4 times as high as basal width, very slightly wider at vertex than at base. Basal callus somewhat higher than wide, rounded, oval, brown, about half the width of the frons, and produced above in a fine line about one-third the distance to the vertex. Subcallus yellowish grey pollinose. Antennae dirty yellowish brown, the first segment lighter, the annulate portion darker. First segment inflated, beset with black hairs which are densest on the dorsal projection. Second segment scale-like, the dorsal tooth moderate and beset with black hairs. Third segment with a prominent dorsal angle and bowed ventrally, the basal part considerably wider than the first segment, but not as wide as long. The length of the annulate portion is to that of the basal portion as 3 to 4. Clypeus and genae light grey pollinose, the former with sparse pale hairs, the latter with long white hairs. Palpi strongly inflated basally, slender apically, dusty grey and with numerous black hairs, about as long as antennae. Proboscis dark brown, a little longer than palpi, the labella about half the length of the proboscis.

Mesonotum dark grey, rather thickly clothed with black and pale silvery hairs. The silvery hairs form a narrow mid-dorsal stripe, two dorso-lateral stripes, and a rather wide lateral border to the mesonotum. Prescutal lobe reddish, with black hairs. Scutellum concolorous with mesonotum, dark haired on the disk, light haired around the margin. Pleura and sternum dark grey pollinose with rather abundant pale hairs.

Wings completely hyaline, the stigma very pale straw colored, all cells but the anal widely open, no appendix on 3rd vein. Femora and coxae dark greyish, mostly with pale hairs, tibiae dusky yellowish with dark hairs on the outer surfaces, pale hairs on the inner. Fore tibiae darker apically, and with pale hairs on the proximal third. Tarsi dirty brownish.

Abdomen uniformly dull black or somewhat reddish on the sides of the first two or three tergites, covered with dense short hairs of black and silvery color, the silvery hairs forming a prominent mid-dorsal contiguous row of triangular spots, a dorso-lateral series of oval or oblong non-contiguous, parallel sided spots on the first to fifth tergites on each side, and narrow lateral margins to tergites one to six. Beneath the abdomen is dark slate grey, sometimes pinkish on the first few sternites,

with narrow lighter hind margins and clothed with grey pollinosity and sparse pale hairs.

Holotype ♀ and 3 ♀ Paratypes from Miraflores, C. Z., Jan. 10, 1930, (L. H. Dunn collector). 1 ♀ Paratype from Ancon, C. Z., (L. H. Dunn collector). Holotype and 2 Paratypes to be deposited in the M. C. Z., Harvard University, Cambridge, Mass. 1 Paratype in the U. S. N. M.

This species is similar to *amplifrons* on the one hand, from which it differs in largely black legs and irregular stripes, and to *maya* on the other, from which it differs in wholly black color, prominently striped thorax, whitish vestiture, and by the lateral stripes not being at all oblique.

Tabanus (Neotabanus) lineola Fab.

Under this name I include an abundant, widespread and polymorphic species, which in various forms and under a multitude of names, appears to range from Canada to the Argentine Republic. Although I have examined a good many hundreds of specimens from Southern Brasil, Panama and the United States, and a smaller number of specimens from perhaps 30 additional localities, I have seen practically no material from Mexico, from the area lying between Bahia and the mouth of the Amazon, from Western South America south of Colombia, or from Uruguay and Argentina. The lack of Mexican material is especially unfortunate, as it is there that the Neotropical and Nearctic forms would be expected to meet. The present arrangement of the various forms is thus in no sense to be taken as final.

In regard to the use of the terms "form," "variety" and "subspecies," perhaps a word of explanation is necessary. I regard subspecies as populations which are geographically separated from other similar populations, and which show morphological differences from those populations, but which freely interbreed, or are assumed to be able to interbreed, with the formation of morphologically intermediate forms, where their ranges overlap. This is essentially the definition of Bates (1935), but while he uses the term "Choromorph" as being more precise, "subspecies" seems now well established in many branches of zoology for this taxonomic concept. It follows from the above that two subspecies of the same species cannot occupy the same geographic area in toto. There may, of course,

be a fairly wide band of territory where their ranges overlap, or the barriers which kept them spearate may have been removed sufficiently recently so that interbreeding has not had time to erase their morphological differences, but such cases must form a rather rare exception. For the morphologically distinct forms found occupying the same area, the choice must be made between considering the form a full species, or a "variety." I regard a variety as a morphologically distinct form found occupying the same range as the species, and showing all degrees of intermediacy with it.

In dealing with the present complex, many difficulties have arisen in applying these two definitions to specific cases. Lack of material from critical areas has made it difficult to define the ranges of the various forms, and forms which seem worthy of specific rank in one area, intergrade completely in another. For these reasons, I have concluded that it is best to treat all the forms as varieties for the present. Although a variety has no nomenclatorial standing, most of the names used here were proposed as specific names, and hence are available should later revision necessitate their return to subspecific or specific rank.

The problem of assigning a name to a given specimen of this group, especially a female, is exceedingly difficult, as the various varieties often intergrade completely, while some varieties are difficult to distinguish from closely allied species. The species as a whole may be characterized as follows:

Eyes bare in both sexes, those of the male with the two types of facets very little or very greatly differentiated in size. Frons from four to seven times as high as wide, nearly always widest at vertex, sometimes widest in the middle. Frontal callus square, rounded, or somewhat higher than wide, yellow to black. Coloration exceedingly variable, ranging from pale yellowish brown to nearly black. Vestiture of the thorax yellow, grey, unicolorous or obscurely striped, often with irridescent scale-like hairs. Legs variable, wholly yellow to nearly all black, but the fore tibiae always bicolored. Abdomen always three-striped, but the lateral stripes sometimes faint or reduced. Stripes white or yellow, broad or narrow, even or irregular.

The various varieties may be separated by the aid of the following keys, except that there will always be a residuum of specimens of intermediate character.

KEY TO MALES

1. Enlarged facets of eye very much larger than small facets, and occupying at least ⅔ of eye area, the line of demarkation between the two types very abrupt 2

   Enlarged facets of eye at most only two or three times as large as small facets, and occupying only about ½ eye area, the line of demarkation between the two types not very clearly defined 3

2. Fore coxae and mid and hind femora wholly yellow. Thorax yellowish brown pollinose, yellowish haired, unstriped. Scutellum, at least apex, yellowish red. Abdomen yellowish brown; no dark on first or second tergites. Median stripe broad, parallel sided, yellow haired. Lateral stripes narrow, obsolescent, yellow haired. Between the stripes the vestiture is orange brown, with a few black hairs on the terminal segments. Venter immaculate, yellow ..... var. **carneus**

   Fore coxae and bases of mid and hind femora at least ⅓ blackish. Thorax grey pollinose, whitish haired, rather faintly dark striped. Scutellum dark. Abdomen yellowish to brown, with a more or less well defined blackish patch beneath the scutellum and on the middle of the second tergite. Median stripe broad, parallel sided, white haired. Lateral stripes well defined, either parallel sided or slightly irregular, white or creamy haired. The abdomen is mostly black haired between the stripes. Venter pale yellowish or brownish, with occasionally a dark median patch or patches on the anterior sternites, and the terminal sternite black ..... var. **lineola**

3. Fore coxae and at least basal third of mid and hind femora black 4

   Fore coxae yellowish, the mid and hind femora at most slightly dusky at base 5

4. Thorax blackish, brown to yellowish pollinose, and with an unusual number of irridescent scale-like hairs mixed with the vestiture. Abdomen yellowish brown, the rather prominent, parallel sided stripes rich yellow haired, the intervals between them black haired. First and second sternites with a prominent black median patch, and terminal sternites black, otherwise venter clear yellow. Wings markedly smoky, var. **stenocephalus**

   As above, but whole insect darker, nearly black, the abdominal stripes pure white to somewhat creamy, the legs extensively black, the venter with a broad mid-ventral black band ..... var. **plangens**

5. Median abdominal stripe very narrow. Abdomen brownish, with a black spot on first two tergites. Lateral stripes faint, broken up into spots. Stripes yellowish white haired, intervals blackish. Thorax blackish or dark grey, rather prominently striped. Scutellum reddish. Venter pale, with a more or less distinct dark patch on first two sternites, var. **scutellaris**

   Median abdominal stripe rather broad; lateral stripes prominent, continuous. Abdomen all yellow, light brown haired, the stripes pale yellow haired. Thorax grey, with yellowish grey tomentum and hairs, unstriped. Scutellum concolorous or slightly lighter than thorax. Venter pale, with or without a small dark spot at base ..... var. **ochrophilus**

KEY TO FEMALES

1. Fore coxae and mid and hind femora pale or yellowish, never more than a slight infuscation at base. Scutellum reddish, yellowish or concolorous with mesonotum 2

   Fore coxae and mid and hind femora at least ⅓ black at base. Scutellum always concolorous with mesonotum 3

2. Wings always hyaline. Ground color pale brown to black. Frons rather broad, with a large square basal callus, and generally rather large oval median callus. Mesonotum obscurely striped. Scutellum reddish apically. Median abdominal stripe white, generally somewhat irregular. Lateral stripes often creamy, usually irregular and step-like ... var. **scutellaris**

Wings often smoky, or the veins brown margined. Ground color yellow to brown. Frons rather narrow, convergent, the basal callus small, rounded, the median callus slender or absent. Mesonotum unstriped. Scutellum concolorous with mesonotum, or reddish or yellowish, wholly or in part. Median stripe yellow or white, generally quite broad and even. Lateral stripes variable.....var. **carneus;** var. **ochrophilus**

3. Wings always entirely hyaline. Body color pale brown to black, the stripes white, greyish, or creamy, often irregular. Frons rather narrow to broad, convergent.....var. **lineola**

Wings always somewhat smoky, the veins generally narrowly brown margined..... 4

4. Whole insect black or predominantly blackish, the lighter pollinosity mostly greyish. Legs extensively blackish. Stripes white or greyish..var. **plangens**

Whole insect predominantly yellow, the lighter pollinosity yellowish. Legs extensively yellow. Stripes rich yellow, the intervals black haired, var. **stenocephalus**

In regard to the names used for the various varieties, I have endeavored to list under each variety the names which seem definitely to refer to that form. Names preceded by a query, I consider probably to refer to the form in question. By using *lineola* Fab. 1794 for the whole complex and treating the various forms as varieties, all other names except *occidentalis* Linn. 1767, which may have been used for a member of this complex, become synonyms; and since varieties have no nomenclatorial standing, I have felt free to choose names on the basis of the availability of types or completeness of description, without regard to priority. In regard to *occidentalis* Linn. considerable confusion seems to exist. The original description is quite inadequate. Kröber (1933, p. 359) refers to a male in the Vienna Museum as type, with a query. This was probably one of the specimens used by Wiedemann, as it bears a label in his handwriting, according to Kröber. It may or may not have been the same as Linnaeus' species, but was almost certainly not his type. In the Hine collection there is a female from

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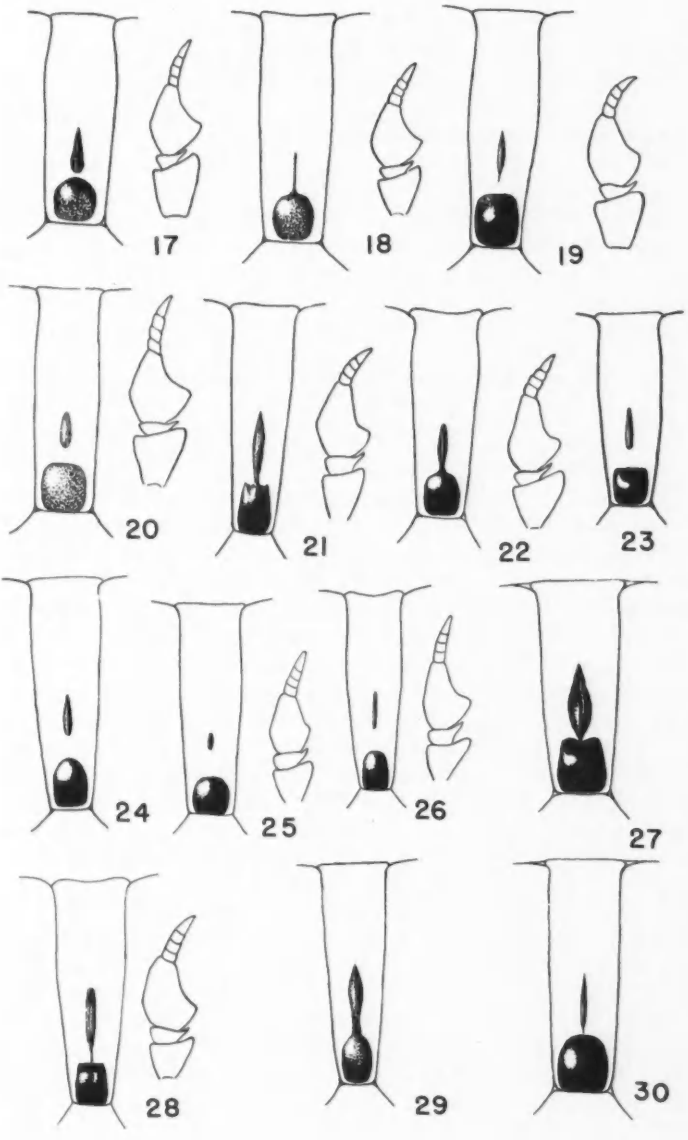
EXPLANATION OF FIGURES

(Also see page 158)

PLATE II

Fig. 17. *T.* (*N.*) *amplifrons* Krōb. Panama. Fig. 18. *T.* (*N.*) *dunni* sp. nov. Holotype. Fig. 19. *T.* (*N.*) *maya* Beq. Panama. Fig. 20. *T.* (*N.*) *triangulum* Wied. São Paulo, Brasil. Fig. 21. *T.* (*N.*) *lineola* var. *carneus* Bell. Moja Pollo, Panama. Fig. 22. *T.* (*N.*) *lineola* var. *carneus* Bell. Matto Grosso, Brasil. Fig. 23. *T.* (*N.*) *lineola* var. *carneus* Bell. Mt. Hope, C. Z., Panama. Fig. 24. *T.* (*N.*) *lineola* var. *carneus* Bell. Mt. Hope, C. Z., Panama. Fig. 25. *T.* (*N.*) *lineola* var. *carneus* Bell. (grey form). Moja Pollo, Panama. Fig. 26. *T.* (*N.*) *lineola* var. *stenocephalus* Hine. Moja Pollo, Panama. Fig. 27. *T.* (*N.*) *lineola* var. *scutellaris* Wlk. Wyoming, U. S. A. Fig. 28. *T.* (*N.*) *lineola* Fab., typical form. Arkansas, U. S. A. Fig. 29. *T.* (*N.*) *lineola* Fab., typical form. Rochester, N. Y., U. S. A. Fig. 30. *T.* (*N.*) *lineola* Fab., gulf coast form. Munroe Co., Florida, U. S. A.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South America bearing a label, "occidentalis ? comp. at B. M." and a yellow "Comp. with type" label, which is the same as *carneus* or *ochrophilus* of the present paper. The *occidentalis* of Wiedemann (1828) and Kröber, who followed him, seems definitely to have been *stenocephalus* of the present paper. Kröber placed *stenocephalus* Hine as a "species dubia." If Hine's specimen was really conspecific with the specimen he saw at the British Museum, and the latter was really Linnaeus' type, then *occidentalis* becomes the correct name for the species. However, *lineola* is now well established in the literature, and Fabricius' type, or what remains of it, has been examined by recent students, so there seems to be no useful purpose served by reverting to the older name.

Tabanus (Neotabanus) lineola Fabricius, typical form

(Pl. II, figs. 28, 29, 30)

Tabanus lineola Fabricius, 1794, Ent. Syst., V, 4, p. 369. (♀; America Boreali.)
Stone, 1938, U. S. Dept. Agric. Misc. Publ. No. 305, p. 122, fig. 57A. (♂, ♀; Maine to Florida, Westward to Texas.)

This and the following variety will be discussed in a forthcoming paper by Dr. C. B. Philip, to whom I owe the loan of much valuable material and innumerable helpful suggestions and criticisms. I am not in a position to allocate the various references to "lineola" to their proper varieties, and will leave that to Dr. Philip. This variety appears to range over most of Eastern North America as far west as eastern Texas. Specimens from the Gulf coast of Louisiana have the stripes exceedingly broad and pale, and the frons as broad as in *scutellaris*, but are connected by a series of intergrades to the typical form. This local variant is what Hine called *T. quinquevittatus* Wied. (1906, Ohio Naturalist, VII, p. 26).

Tabanus (Neotabanus) lineola var. **scutellaris** Walker

(Pl. II, fig. 27)

Tabanus scutellaris Walker 1850, Insect. Saunders., Dipt., V, 1, p. 27. (♀; Bolton, North America.)
Tabanus lineola var. *scutellaris* Stone, 1938, U. S. Dept. Agric. Misc. Publ. No. 305, p. 123. (British Columbia to Massachusetts, south to Arizona and Georgia.)

This form occurs with the typical form throughout most of its range, but replaces it almost entirely in the western part of North America. The typical form is said to be more common along the coast, the present form dominant inland. Specimens from the southwest are very pale, with broad stripes, but this appears to be but a variant perhaps due to environmental factors.

Tabanus (Neotabanus) lineola var. **carneus**

(Pl. II, figs. 21–25)

Tabanus carneus Bellardi, 1859, Ditt. Mess., I, p. 62. Hine, 1906, Ohio Naturalist, VII, 2, pp. 21, 23; 1925, Occ. Pap. Mus. Zool., Univ. Michigan, No. 162, p. 53. Krōber, 1933, Rev. Ent., III, 3, pp. 340, 341, 355; 1934, Op. cit., IV, 3, p. 292. Bequaert, 1940, Bull. Ent. Res., XXX, pt. 4, pp. 451, 453.

Tabanus appendiculatus Hine, 1906, Ohio Naturalist, VII, 2, p. 22. Bequaert, 1926, Med. Rep. Harvard Exp. Amazons, Pt. II, p. 227. Krōber, 1933, Rev. Ent., III, 3, p. 357.

Tabanus (Neotabanus) carneus var. *appendiculatus* Krōber, 1934, Rev. Ent., IV, 3, p. 292.

Tabanus trillineatus Bequaert, 1926, Med. Rep. Harvard Exped. Amazons, Pt. II, pp. 227, 228. Hine, 1906, Ohio Naturalist, VII, 2, pp. 21, 27.

Tabanus truquii Krōber (nec. Bell., nec. Hine, nec. Stone), 1929. Ann. Naturhist. Mus., Wein, XLIII, p. 248 (the white striped variety).

?*Tabanus fur* Williston, 1901, Biol. Cent. Amer., Dipt., I, Suppl., p. 261. (nec. *T. fur* Will., 1887.)

?*Atylotus eutaeniatus* Bigot, 1892, Mem. Soc. Zool. France, V, p. 664 (♂; Brasil). Krōber, 1933, Rev. Ent., III, 3, p. 357. (Type seen, no other specimens.)

?*Tabanus dorsovittatus* Macq., 1855, Dipt. Exot., Suppl. V, p. 30 (♀; South America). Krōber, 1933, Rev. Ent., III, 3, p. 356. (Type seen.)

?*Tabanus (Neotabanus) dorsiger* var. *pallidefemorata* Krōber, 1929, Ann. Naturhist. Mus. Wein, XLIII, p. 249 (♂, ♀; Amazonas); 1933, Rev. Ent., III, 3, p. 352 (Amazonas, Peru, Honduras, Canal Zone).

?*Tabanus consequa* Walker, 1850, Newm. Zool., VIII, Appendix, p. 121; 1854, List. Dipt. Brit. Mus., V, p. 213. Krōber, 1933, Rev. Ent., III, 3, p. 353 (♀; Brasil. Type seen.)

The color of the thorax varies from strongly yellowish brown to pale steel grey, and of the abdomen from honey yellow to nearly black. The abdominal stripes may be yellow or practically white. The size is also quite variable, some specimens being less than 9 mm. long while extra large examples may reach 15 mm. Krōber's (1933) description of his *dorsiger* var. *pallidefemorata* may have been based, at least in part, on such small specimens.

I have examined Hine's types of *appendiculatus* in Columbus, Ohio, which consist of 7 ♀ from various localities in Guatemala, and 1 ♂ from Belize, Br. Honduras. They seem to represent a darker segregate with rather whitish stripes. There are also specimens of the variety here called *carneus*, labelled as *subsenex* Walk., *trilineatus* Latr., and *eutaenius* Bigot by Hine. *Tabanus truquii* Krōber, 1929, seems also to have been based on the whitish striped form of this variety. *T. fur* Williston may or may not be the same, the striped thorax would suggest some other species. Hine (1925, p. 33) suggested the synonymy, and at any rate there is an earlier *T. fur.* of Williston.

Distribution: I have seen specimens from Guatemala, British Honduras, Panama, Colombia, Venezuela, Surinam, Trinidad, Peru, Paraguay and the states of Pará, Bahia, Goyaz, Rio de Janeiro, São Paulo and Matto Grosso in Brasil. The

variety was described from Mexico, and Kröber reports it also from Costa Rica and Ecuador.

Panama records: The form is abundant throughout the Republic, flying at all seasons of the year. At one locality, Moja Pollo on the Chagres River above Gamboa, where collections on horse bait have been made every two weeks for the past year, over 5600 specimens have been taken, about 49% of all *Tabanidae* collected at this station.

Tabanus (Neotabanus) lineola var. **plangens** (Walker)

Tabanus plangens Walker, 1854, List. Dipt. Brit. Mus., V, p. 199. Kröber, 1933, Rev. Ent., III, 3, p. 347.
?*Tabanus modestus* Wiedemann, 1828, Auss. Zweifl. Insect., I, p. 146. Hine, 1906, Ohio Naturalist, VII, 2, pp. 22, 25.

I have seen no males of this form, but from Kröber's description I gather that the eye is like *stenocephalus*. The frons and antennae of the female are also as in *stenocephalus*. In Central America it seems to be rather uncommon, but in Southern Brazil it is quite abundant. There is also what I consider to be a dark form of *triangulum* in Southern Brazil, and the two are very close in appearance. *Plangens* may be distinguished by the callus being oblong, or higher than wide, and the lateral abdominal stripes being parallel sided or slightly irregular, while in *triangulum* the callus is rounded or square, and the lateral stripes a series of markedly oblique spots.

The description of *T. modestus* Wiedemann fits the present form quite well, and the synonymy has been often suggested. Kröber (1933), however, says that the types are apparently lost. He compared material with Walker's type of *plangens*. What Lutz (1928, Pl. 9, fig. 12) calls *modestus* looks more like the dark form of *triangulum* to me. In the Hine collection there is a female from São Paulo, Brazil, det. Lutz, which is labelled *modestus*, and this agrees with what I call *plangens*. Also in the Hine collection are 2 females, both labelled "plangens Wlk." and "comp. with type." One of these (Pto. Cortez, Honduras II–23–06) is *carneus* Bell. of the present paper, the other (Atrato Valley, Colombia) agrees with the present interpretation of *plangens* Wlk. Bequaert (1926) recognized both names as applying to distinct species. His *modestus* seems to fit the present species best.

Distribution: I have seen material from Honduras, Panama, Colombia and the Brazilian states of Bahia, Goyaz, Rio de Janeiro, São Paulo, Paraná and Matto Grosso. Kröber records

it in addition from Costa Rica, Peru, Paraguay, and Bequaert from Amazonas and Pará. Walker's type was from Pará.

Panama records: Darien (Dunn); Juan Mina Station, Rio Chagres, Jan. 3, 1939; El Valle, Coclé Prov., Dec. 17, 1939, June 30, 1940; Fort Randolph, C. Z., Jan. 23, 1929 (Curran); Rio Pequeni Police Sta., May 11, 1940.

Tabanus (Neotabanus) lineola var. **stenocephalus** (Hine)

(Pl. II, fig. 26)

Tabanus stenocephalus Hine, 1906, Ohio Naturalist, VII, 2, p. 27. (♂, ♀; Puerto Barrios, Morales, and Panzos, Guatemala.)

I have examined the types of this form in the Hine collection at Columbus, Ohio. They consist of 4 ♀ and 2 ♂ Cotypes, so labelled, and 2 ♀, 4 ♂ additional specimens, probably also types, all from various localities in Guatemala, taken in 1905. Kröber's *occidentalis* (1933) probably includes this variety, as he mentions specimens from Yucatan and Costa Rica. In Central America this form is quite distinct, and I have seen no specimens showing intergrades to *carneus*, but in Southern Brazil the situation is very different. There both small and large facetted males occur, and the females show every intergrade between those with entirely light coxae and femora, and those with dark coxae and the femora dark at base. The small facetted males before me, from Brazil (São Paulo), have the fore coxae dark, the femora ½ black at base and a dark patch on the first 2 sternites, while of 5 large facetted males, 2 have the coxae and femora entirely yellow, 2 have the femora slightly dusky at base, and 1 has the femora extensively dark. All have a blackish spot on the first and second sternites. The large facetted, dark legged males agree well with *eutaeniatus* Big.

Distribution: I have seen specimens from Guatemala, British Honduras and Panama. Kröber (1933) records it (as *occidentalis*) from Yucatan and Costa Rica.

Panama records: Moja Pollo, Chagres River region, March to January (probably throughout the year); El Real, Darien, Feb. 7, 1940, and Aug. 15, 1930 (Dunn); Ft. Randolph, C. Z. Feb. 11, 1930 (Dunn).

Tabanus (Neotabanus) lineola var. **ochrophilus** (Ad. Lutz)

Neotabanus ochrophilus Lutz, 1914, Mem. Inst. Osw. Cruz, VI, 1, p. 49; 1928, Est. Zool. Parasit. Venezolanas, p. 56, Pl. IX, fig. 10.

This variety is only distinguishable in the male sex, being a pale legged form with small facetted eyes. As noted under

stenocephalus, the four tropical American forms all occur in Southern Brazil, and seem there to intergrade perfectly with one another. My identification of the male is based on a specimen from Manguinhos, Rio de Janeiro, det. Lutz, in the Hine collection. The female of the pair, same data, is indistinguishable from *carneus*. I have also a male from Petropolis, Rio de Janeiro, which agrees, except that the hind femora are slightly dusky at base. Lutz' figure (1928) is poor, and probably misled Bequaert (1940), Bull, Ent. Res., XXX, 4, pp. 451, 452). It might be best to drop the name altogether, but I prefer to retain it until the relationships of the South American forms can be better worked out.

Distribution: I have seen males only from Southern Brazil (States of Rio de Janeiro and São Paulo).

Tabanus (Neotabanus) maya J. Bequaert

(Pl. II, fig. 19)

Tabanus maya J. Bequaert, 1932, Jour. New York Ent. Soc., XXXIX, (1931), p. 546, fig. 2 (♀; Chichen Itza, Yucatan, Mexico).

Tabanus (*Tabanus*) *maya* Kröber, 1934, Rev. Ent., IV, 3, p. 311. (No material seen.)

Material in the Hine collection from localities in Mexico and Guatemala is labelled *subsimilis* Bell., and the description fits fairly well, except for the phrases "ad radican antennarum subcastanea" which would seem to indicate a bare subcallus, and "scutello ad basim cinerascente, ad marginem carneo" which is not true of the present species.

A male specimen before me from Pacora, R. de P., March 26, 1939, (Allotype), is easily associated with the female on color characters. The abdomen is largely yellowish, the lateral stripes not so pronounced as in the female, and there is a prominent black triangular spot on the first two tergites. Eye holoptic, bare, the large facets not much larger than the small, and not sharply demarkated from them.

Distribution: Southern Mexico to Panama.

Panama records: Juan Mina and Moja Pollo, Chagres River region, December to July, most abundant from April to June; Miraflores, C. Z., Jan., 1930 (Dunn). Apparently rather local.

Tabanus (Neotabanus) triangulum Wied.

(Pl. II, fig. 20)

Tabanus triangulum Wied., 1828, Auss. Zweifl. Ins., I, p. 143 (♀; Brasil).

Tabanus (*Neotabanus*) *lineola* Kröber, 1933, Rev. Ent., III, 3, p. 344 (nec. *T. lineola* Fab., 1794).

?*Tabanus* (*Neotabanus*) *uruguayensis* Kröber, 1933, Rev. Ent., III, 3, p. 346 (nec. *T. uruguayensis* Arribalzaga, 1882).

?*Tabanus* (*Neotabanus*) *uruguayanus* Kröber, 1934, Rev. Ent., IV, 3, p. 294.

Wiedemann's description fits the present species, especially since he states his specimen was much rubbed, which would bring into prominence the black triangular mark on the first two abdominal tergites. Kröber (1933, p. 361) was unable to locate the type, and did not recognize the species. Lutz used the name a number of times in lists, but with no descriptions, and I have not seen this species determined by him. I have, however, a specimen determined by Dr. Oliveria Castro, who collaborated with Lutz, and had access to his collection, so that it is probable that his references were to the present species.

Kröber's descriptions of *lineola* and *uruguayanus* apply almost equally well to my material, except that *uruguayanus* is said to have the mid-dorsal stripe of a series of triangles. This is true of a few of my specimens, but they differ in no other way from those with a uniform mid-dorsal stripe. Both the color of the abdomen and the width of the abdominal stripes are very variable, very narrow to quite broad. The lateral stripes show a tendency to be markedly step-like, but in some specimens they are nearly parallel sided.

Distribution: I have seen material from the Brazilian states of Goyaz, Rio de Janeiro, São Paulo, Paraná and Matto Grosso, and from Paraguay. Kröber lists Uruguay, Peru, Bolivia and Argentina in addition.

Tabanus (Neotabanus) strigimaculus sp. nov.

(Pl. I, fig. 5)

Female—Length 18 mm., of wing, 14 mm.

Frons and antennae as figured. Frons yellowish grey pollinose, callus dark brown, nearly black. Face and cheeks grey, beard sparse, white. Palpi yellowish, mostly black haired. Eyes bare, dark purplish with three narrow green bands, one below and two above the middle. Mesonotum chocolate brown, grey pollinose and with dark and light hairs forming indistinct stripes. Scutellum concolorous. Pleura grey pollinose and white haired. Legs reddish brown, the coxae and all posterior legs largely white haired, the fore femora, apical half of fore tibiae and all tarsi blackish and black haired. Base of fore tibiae white and white haired. Wings hyaline, the veins all blackish, faintly brown margined. Fork of third vein with a short appendix. Abdomen chocolate brown, with a continuous white haired mid-dorsal stripe of medium width, (.75 mm.) on segments one to six. Dorso lateral stripes formed of a series of more or less oblong, unconnected white haired patches which are not oblique, and which extend from tergites two to five inclusive. The dorsum of the abdomen is otherwise black haired. Sternites and extreme sides of tergites pale chocolate, white pollinose and white haired.

Holotype ♀ Vera Cruz, São Paulo, Brasil (A. Ramalho coll.). To be deposited in the collection of the Instituto de Hygiene, São Paulo, Brasil.

This species is the largest *Neotabanus* known to me, with the possible exception of *T. attenuatus* Wlk., which is described as a yellowish species with a quite different eye pattern.

Tabanus (Neotabanus) amplifrons Kröber

(Pl. II, fig. 17)

1933, Rev. Ent., III, 3, p. 354 (♀; Venezuela); 1934, Op. cit., IV, 3, p. 292.
?*Tabanus truquii* Bellardi, 1859, Ditt. Mess. Pt. 1, pp. 64–65 (♂; Mexico).
Tabanus truquii Hine, 1906, Ohio Naturalist, VII, 2, pp. 22, 28 (♂, ♀; Guatamala).
Tabanus trilineatus Bequaert, 1940, Bull. Ent. Res., XXX, pt. 4, pp. 450, 452 (Trinidad). ? Not *T. trilineatus* Latreille, 1811.

The earliest name for this species seems quite impossible to determine at present, but a brief resumé of opinions will perhaps serve to explain the conclusions expressed in the present paper. Bellardi's description agrees very well, but it is impossible to tell from it whether the large eye facets were much or only slightly larger than the small facets, so that I prefer for the present, following the suggestions of Drs. C. B. Philip and Alan Stone, to leave the name in abeyance. Bequaert stated that Major E. E. Austen had identified the species as *trilineatus* Latr. Through the kindness of Dr. C. B. Philip, I have been provided with a copy of Latreille's (1811) description. As was to be expected, it might fit almost any trivittate species. The description of the head is, however, very peculiar. "Les yeux sont d'un brun noirâtre, et séparés dans toute leur longeur, ce qui me fait presumer que l'individu que je decris est une femelle; l'intervalle compris entre eux est uni, et offre en devant une petite éminence d'un brun luisant portant les yeux lisses." Wiedemann (Auss. Zweifl. Insekt., I, p. 169, 1828) also was unable to identify the species, and called attention to the peculiar description of the head. It is possible that *trilineatus* was one of the *callosus* group, but it would be difficult to tell which. Kröber places *trilineatus* Latr. as a synonym of *lineola* Fab., though, as will be shown later, his *lineola* is not the same as the *lineola* of North American authors. In 1929 (Ann. Nat. Mus. Wien, XLIII, p. 248) Kröber describes under *truquii* Bell. a dark, greyish white striped form from the Amazon, which is not the same as his later *amplifrons*, but appears to be a greyish form of *carneus* close to what Hine called *appendiculatus*, at least in part. Later (1933, 1934) he placed Bellardi's name as a probable synonym of *occidentalis* Linn. In the Hine collection,

specimens of the present species are labelled *dorsiger* Wied., while specimens labelled *trilineatus* "comp. with type" are what I here call *carneus*.

The species seems to be relatively uniform throughout its range. The frons is relatively wide, and parallel sided. The callus nearly square, yellow to brown, and the whole insect of a definitely grey tone, greyer than any of the other species familiar to me. The abdominal stripes are for the most part chalky white, but when underlain by a more than usually reddish ground, assume a pinkish tone. The wings are always completely hyaline, the stigma pale yellow and very slender. The hind femora of all females I have seen are entirely pale, those of the male always extensively blackish at base. The female venter always bears a large median dark patch on the first and second sternites, and often a complete broad black mid-ventral stripe or band. The eyes of the male have the facets very little differentiated, the larger merging imperceptibly into the smaller. The eyes are also densely pubescent, the pubescence thickest and longest on the larger facets, becoming sparse, short and barely visible on the smaller facets.

The species may be distinguished from the forms of *vittiger* by its greyer color, narrower frons, black scutellum and pure white stripes, as well as the male eye characters. From *lineola* and its forms the yellow callus, pale femora, grey color, black ventral patch, and glass clear wings should serve to separate it, as none of those forms has all these characters.

Distribution: I have seen material from Trinidad, Venezuela, Amazonas, Colombia, Panama, Guatemala and Texas.

Panama records: Ancon, C. Z. (Dunn); Miraflores, C. Z., Jan. 10, 1930 (Dunn); Panama City, May 16, 1930 (Dunn); Moja Pollo, Chagres River region, Feb., April, May, June, July and September, 1940.

Tabanus (Neotabanus) vittiger Thomson

(Pl. I, figs. 15, 16)

Tabanus vittiger Thomson, 1868, Svensk Freg. Eugenies Resa, Vet. Iakttag., 2, Zool., Pt. 1, Insekter, Heft 12, p. 451. Coquillett, 1901, Proc. Wash. Acad. Sci., III, p. 373. Johnson, 1924, Zoologica, V, p. 87. Curran, 1932, Norwegian Zool. Exped. Galapagos, Medd. Zoologiske Mus., Oslo, No. 30, p. 349; 1934, Proc. Cal Acad. Sci., Ser. 4, XXI, 13, pp. 150–151. Bequaert, 1933, Proc. California Acad. Sci., (4) 21, p. 136. (Galapagos Is.)

Tabanus guatemalanus Hine, 1906, Ohio Naturalist, VII, 2, p. 24. Krōber, 1933, Rev. Ent., III, 3, p. 358; 1934, Op. cit., IV, 3, p. 293.

Tabanus truquii Bequaert (nec. Bell.), 1940, Rev. Ent., XI, 1–2, pp. 352–357, fig. 30. Stone, 1938, U. S. Dept. Agric. Misc. Publ. No. 305, p. 123.

Tabanus appendiculatus Bequaert, 1940, Bull. Ent. Res., XXX, Pt. 4, pp. 451, 453 (♂ only, the ♀ is either *carneus* or *ochrophilus*).

I have seen Hine's types in Columbus, Ohio. They consist of 3 ♂ and 3 ♀ from San José, Guatemala, Feb. 5, 1905, and an additional female, not labelled as type, but with the same data. There is also a male from Mazatlan, Mexico. In addition to these, I have material from Panama and Trinidad which I have compared with the types. I believe also that *truquii* Stone, 1938, and *truquii* Bequaert, 1940, as well as *vittiger* Thomson, 1868, and an unnamed variety recently sent to me by Dr. Philip from the Southwestern United States are but varieties, subspecies or local races of the same thing. All, with the exception of *vittiger*, whose male is apparently unknown, have the male eye differentiated into large and small facets, the large facets very much larger than the small, and bearing rather dense and long pubescence. The females vary much in color, but seem always to have a relatively broad frons. While it may seem unwise to base the differentiation of this group almost wholly on the structure of the male eye, I have been unable to find any other character which seems to be anything like as consistent. The determination of female specimens is very much like trying to name the species of *Culex* from females alone, but the following key may be of some assistance in separating the various forms. These forms, incidentally, are probably what I consider true subspecies, i. e., geographical races, as from the limited material at hand, no two of them appear to occur in the same area.

KEY TO FORMS OF VITTIGER

1. Mid and hind femora dark or dusky at base. Coloration essentially black and white, with little brown or yellow..... 2
   Mid and hind femora wholly pale. Coloration often yellowish or brownish... 3
2. Mid abdominal stripe rather broad and white. Frontal callus brown,
   (Galapagos) **vittiger**
   Mid abdominal stripe rather narrow. Frontal callus black,
   (**truquii** Stone, 1938) (Southeastern U. S.) **subsp. A**[3]
3. Coloration essentially black and white, the thorax grey, the abdominal stripes white or pale grey,
   (**truquii** Bequaert, 1940) (Puerto Rico and Cayman Is.) **subsp. caymanicus**
   Coloration essentially yellowish and brown. Thorax yellowish grey, abdominal stripes yellow..... 4
4. Coloration pale, washed out, vestiture mostly whitish,
   (Southwestern U. S.) **subsp. B**[3]
   Coloration yellowish brown, darker, vestiture yellowish to brown,
   (Trinidad to Mexico) **subsp. guatemalanus**

The different forms, except *vittiger*, fly in company with various forms of *lineola*, and must be distinguished from them.

[3]Subspecies A will appear in the 1942 Psyche, described by Philip as *schwardti*. Subspecies B will appear in the same article by Philip as *nipponlucki*. The above elements of the key which concern these forms and any descriptive item in the above text are by C. B. Philip. The two subspecies are thus described by Philip whether they appear first in Psyche, 1942, or whether the above descriptive references appear first in these Annals.—G. B. F.

Thus "*truquii*" Stone may be distinguished from *lineola* by the reddish scutellum and from *scutellaris* by the basal infuscation of the hind femora. Var. B., which I know only in the male, must be extremely difficult to separate in the female from pallid forms of *scutellaris*, since the femora are said to be pale. "*Truquii*" Bequaert and *guatemalanus* are separable from the *lineola* forms found with them by the much wider frons. *Vittiger* is apparently the only Tabanid found in the Galapagos.

Some explanation is perhaps necessary for the use of the name *vittiger*, since it is not known in the male; and the species as a whole is distinguished mainly on the condition of the male eye. Females of *vittiger* are, however, so like *guatemalanus* and *caymanicus* in structure, and are not closely approached by any other neotropical forms, that it seems highly probable that they belong here.

The West Indian form treated by Dr. Bequaert (1940) as *T.* (*Neotabanus*) *truquii*, is, I believe, a distinct race, for which the subspecific name, *caymanicus*, is here proposed. I have seen the following material in his collection. 1 ♂, 4 ♀, Cayman Is., April 17–August 26, 1938 (C. B. Lewis and G. H. Thompson). 1 ♀, Sta. Tomas, P. de Zapata, Cuba, May 5–9, 1927 (Bruner and Acuña). Since Bequaert has fully described and figured the form (l. c.), it is only necessary to point out a few characters in which it differs from other forms. The whole insect is rather dull and greyish, the mid abdominal stripe rather irregular, in some cases formed of truncate triangles. Lateral stripes quite irregular, almost step-like. Both stripes are greyish and not very well defined. The frons and callus are just like *guatemalanus*, but the callus brown rather than yellow. The male and a female from the Cayman Island lot are selected as Allotype and Holotype.

The two[4] North American varieties will be treated by Dr. C. B. Philip in a forthcoming paper, and I am much indebted to him for allowing me to examine his material.

In Panama, only *guatemalanus* occurs, where it seems to be confined to the drier areas along the Pacific coast, and appears to be rather uncommon.

Panama records: Miraflores, C. Z., Jan. 10, 1930 (Dunn); Balboa, C. Z., Dec. 7, 1929 (Dunn); Chepo, Jan., 1930 (Dunn); Old Panama (Dunn); El Real, Darien Prov., July 15, 1930

[4]See footnote No. 3, p. 180, this article.

(Dunn); West side Ferry landing, opposite Balboa, C. Z., May 7, 1940.

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NOTES ON TABANIDAE (DIPT.) FROM PANAMA

VIII. THE GENERA PITYOCERA, SCIONE AND ESENBECKIA

G. B. FAIRCHILD,
Junior Medical Entomologist,
Gorgas Memorial Laboratory,
Panama, R. de P.

Genus **Pityocera** Giglio-Tos

1896, Bol. Mus. Zool. Anat. Comp. Univ. Torino, XI, No. 224, p. 3, (Monotypic for *P. festae* Gigl.-Tos.). Enderlein, 1922, Mitt. Mus. Berlin, X, 2, p. 339; 1925, Op. cit., XI, 2, p. 298. Kröber, 1930, Zool. Anz., LXXXVIII, 11-12, p. 310.

The genus remains monotypic for a peculiar species known so far only from Panama, where it is quite abundant locally. The genus is placed in the tribe *Pityocerini* with *Elaphella* Bezzi and *Pseudelaphella* Kröber by Enderlein and Kröber. These two genera certainly seem its closest relatives, and form transitions between it and *Fidena*. The long-stalked first posterior cell seems characteristic of the group.

Pityocera festae Giglio-Tos

(Figs. 7, a, b)

1896, Bol. Mus. Zool. Anat. Comp. Univ. Torino, XI, No. 224, p. 4, fig. (♀; forest of Lake Pita and of the Rio Lara, Darien); 1897, Op. cit., XII, No. 276, p. 1 (♀). Hunter, 1900, Trans. Amer. Ent. Soc., XXVII, p. 135. Ricardo, 1900, Ann. Mag. Nat. Hist., (7) V, p. 99. Aldrich, 1905, Cat. North Amer. Dipt., p. 200. Kertesz, 1908, Cat. Dipt., III, p. 147. Surcouf and Gonzalez-Rincones, 1912, Dipt. Vulner. Venezuela, II, p. 86 (♀). Surcouf, 1921, Gen. Insect., Taban., p. 101, Pl. III, figs. 11a, 11b. Kröber, 1930, Zool. Anz., LXXXVIII, p. 311, fig. 5; 1934, Rev. Ent., IV, 2, p. 235.

This insect is immediately recognizable by the remarkable pectinate antennae. In general appearance it is a brown *Fidena*-like fly with smoky wings and dark concolorous brown thorax and abdomen, with small silvery hair tufts on the sides of the last few segments. The legs are pale yellowish, the face snout-like, largely shiny, and the proboscis nearly as long or longer than the whole insect.

The species is not at all uncommon in certain localities in Panama, but the season of flight is very short, my material showing dates from July 29 to Sept. 1. While collecting on the Pequeni river at the head of Madden Lake, C. Z., in August, 1940, I found the species very abundant. It was definitely crepuscular, not appearing much before 6 P. M., and continuing

to fly long after it was too dark to see; only the loud and rather characteristic buzzing of the hovering flies told of their presence. The flies would alight readily on one's person, seeming to prefer the body below the waist, and while they would attempt to bite, they seemed to be dissatisfied with some factor, and seldom remained long enough to draw blood. Visits to the same locality at several other times of year have always failed to reveal their presence.

Distribution: So far known only from Panama.

Panama records: 1 ♀, Gatun, C. Z., July, 1919 (D. E. Harrower). 1 ♀, Quipo, July, 1922 (J. P. Chapin). 10 ♀, Sta. Rosa, Chagres River region, Aug., 1936 (L. E. Rozeboom). 5 ♀, Moja Pollo, Chagres River region, Aug. 18, 21, Sept. 1, 1940. Rio Pequeni, Aug. 18, 1940 (20 ♀), July 29, 1941 (1 ♀).

Genus **Scione** Walker

1850, Insect. Saund., Dipt., I, p. 10 (with *incompleta* as sole species). Coquillett, 1910, Proc. U. S. Nat. Mus., XXXVII, p. 604. Ferguson, 1924, Bull. Ent. Res., XIV, 3, p. 253. Surcouf, 1921, Gen. Insect. fasc. 175, Dipt. Taban., p. 113. Enderlein, 1925, Mitt. Mus. Berlin, XI, 2, p. 299. Kröber, 1930, Stett. Ento. Zeit., XCI, p. 141. Borgmeier, 1933, Rev. Ent., III, 3, p. 301. Kröber, 1934, Rev. Ent., IV, 2, p. 232.

Diclisa Schiner, 1867, Verh. k.-k. zool.-bot. Gesell., Wien, XVII, p. 311; 1868, Reise Novara, Zool., II, Abt. 1, B, Diptera, p. 101 (Type *Pangonia incompleta* Macq.).

Rhinotriclista Enderlein, 1922, Mitt. Mus. Berlin, X, p. 338; 1925, Op. cit., XI, 2, p. 302 (Type, *Diclisa maculipennis* Schin.). Kröber, 1930, Stett. Ent. Zeit., XCI, p. 141. Bequaert, 1931, Journ. New York Ent. Soc., XXXIX, p. 538.

This genus includes a fairly well defined group of Neotropical *Pangoniinae*, whose center of distribution is apparently the Andean region from Peru to Colombia. Several species range into Venezuela and into Central America as far as Southern Mexico, but they seem for the most part to be confined to higher altitudes.

The genus may be recognized by the following combination of characters: Hind tibiae spurred. Ocelli present. Eyes with dense and long pubescence. Face moderately to considerably produced. Palpi parallel to proboscis, rather short, generally less than one-fourth length of proboscis, flattened, appressed, and either broad or slender. Proboscis long, as long as head and thorax, the labium annulate, the labella short and sclerotized. Body rather short and stout, legs slender, neither swollen nor especially hairy. Wings with subepaulet bare, both the first and fourth posterior cells closed and generally petiolate. Wings generally smoky or mottled, occasionally hyaline.

The species are rather similar in appearance, and good specific characters seem to be few, most of the earlier descrip-

tions being nearly worthless. The group is in great need of revision, as Kröber's (1930) paper, the only attempt so far, does not seem to have been entirely successful. Five species have been recorded in the literature as occurring in Central America, but it is doubtful in some cases if the names used were correctly applied. I have before me specimens of four distinct species, three from Panama, and one from localities both north and south of Panama, and it is very likely that other species will be found when the mountains on the Colombian border become better known.

KEY TO FEMALES

1. Wings immaculate, either hyaline or fumose.....2
   Wings with more or less distinct dusky clouds at base, apices of basal cells, fork of third vein and apex; remainder of wing faintly yellowish. Thorax brown, with well marked stripes. Abdomen with a row of small white haired middorsal triangles.....**maculipennis**
2. Large blackish species, the wings brown fumose, the abdomen clothed with bright golden hairs. The thorax dark brownish black, nearly immaculate. Legs nearly black.....**aureopygia**
   Smaller brown or yellowish species. The thorax and abdomen with tufts of contrasting hairs, or the whole insect pale yellowish.....3
3. Thorax prominently whitish striped. Abdomen with white middorsal triangles.....**claripennis**
   Thorax unicolorous, dirty yellowish brown.....**aurulans**

Scione aurulans (Wiedemann)

Pangonia aurulans Wiedemann, 1830, Auss. Zwiefl. Insekt., II, p. 620 (♀; Mexico). Walker, 1854, List. Dipt. Brit. Mus., V, Suppl. 1, p. 120. Osten Sacken, 1878, Cat. Dipt. N. Amer., p. 52. Kertesz, 1900, Cat. Taban., p. 16; 1908, Cat. Dipt., p. 152. Ricardo, 1900, Ann. Mag. Nat. Hist., (7) V, p. 170. Aldrich, 1905, Cat. N. Amer. Dipt., p. 193. Surcouf, 1921, Gen. Insect., p. 127. (*Pangonius*).

Scione aurulans, Hine, 1920, Ohio Journ. Sci., XX, 8, p. 314 (with *P. rostrifera* Bell. and *D. misera* O. S. as syns.); 1925, Occ. Papers Mus. Zool. Univ. Michigan, No. 162, p. 9. Bequaert, 1931, Journ. New York Ent. Soc., XXXIX, pp. 537–538.

Rhinotriclista aurulans, Enderlein, 1925, Mitt. Mus. Berlin, XI, 2, p. 302. Kröber, 1930, Stett. Ent. Zeit., XCI, 2, p. 147.

Pangonia rostrifera Bellardi, 1859, Sagg. Ditt. Messicana, I, p. 47 (♀, ♂; Mexico). Osten Sacken, 1878, Cat. N. Amer. Dipt., Smithson. Misc. Coll., No. 270, p. 52. Williston, 1901, Biol. Centr.-Amer., Dipt., I, Suppl., pp. 252, 253. Aldrich, 1905, Cat. N. Amer. Dipt., p. 193. Ricardo, 1900, Ann. Mag. Nat. Hist., (7) V, p. 169 (*Erephrosis*). Kertesz, 1908, Cat. Dipt., III, p. 166 (*Erephopsis*).

Erephopsis rostrifera, Surcouf, 1921, Gen. Insect. Taban., p. 120.

Scione lurida End., 1925, Mitt. Zool. Mus. Berlin, XI, 2, p. 301 (♀; Colombia; Brit. Honduras). Szilady, 1926, Biol. Hung., I, 7, p. 28.

Fidena rostrifera Kröber, 1933, Arch Naturg. (N. F.) II, p. 284.

?*Diclisa misera* Osten Sacken, 1886, Biol. Centr.-Amer., Dipt., I, pp. 47–48. (♀; Guatemala).

Hine (1920) synonymized *misera* with *aurulans* but Enderlein (1925) and Kröber (1930) claim that *aurulans* has the abdomen wholly light haired, *misera* with considerable black hair. Kröber records specimens from Orizaba, Mexico, and Laristal, Peru, a peculiar distribution, and says that the black

hairs are apparently easily lost, and often are entirely lacking, while the yellow hairs are always present. It would seem rather difficult to separate the species, at least on this character. The species has been recorded from Mexico to Peru, and should occur in Panama, if all these records apply to the same species, but I have seen no Panama records and have not taken the species myself.

Scione aureopygia n. sp.
(Figs. 4, a)

Female—Length 17–18 mm., of wing 15–16 mm.

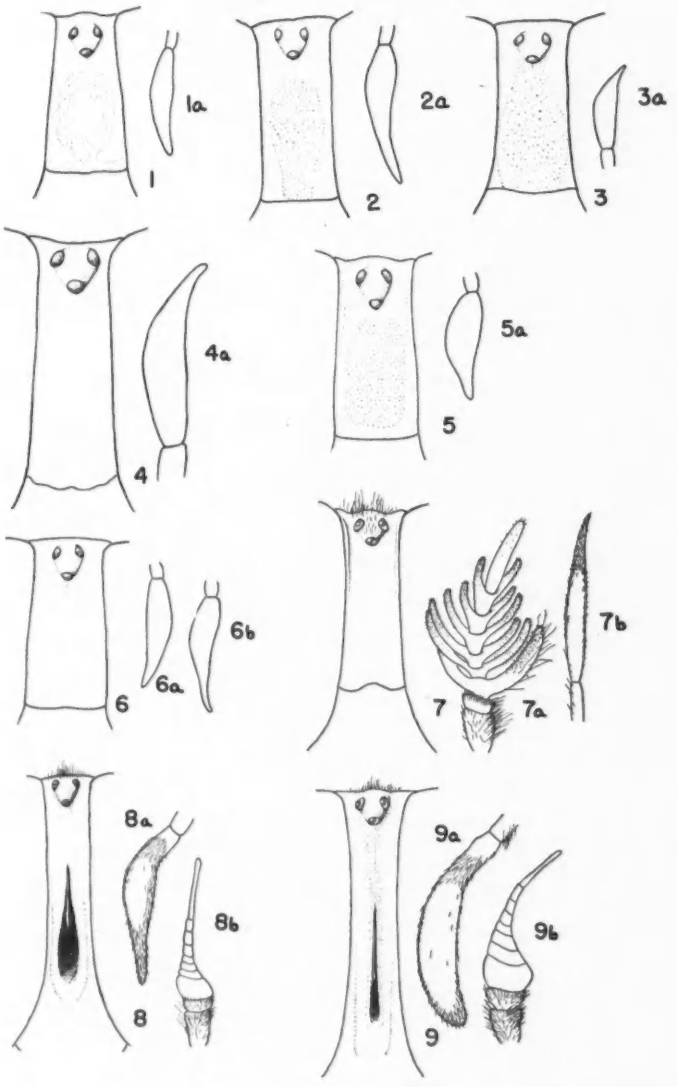
Frons about two and one-half times as high as wide, narrowest at the level of the median ocellus, dark brown pollinose, and with rather sparse short black hairs. The basal suture dividing the frons from the antennal eminence is quite faint. Eyes with unusually short pilosity. Face protuberant, snout-like, dark brown pollinose. Antennae dark brown, the first two segments reddish, the third, of eight annuli, nearly black. The first annulus is much the widest and longest, the segment tapering to the fourth annulus. Terminal palpal segment long, as long as third antennal segment, leaf-like, the margins thickened, and tapering to a sharp point. Proboscis longer than head and thorax, orange brown, the labium not annulate, the labella very small, black and shiny. Beard sparse, blackish.

Mesonotum and scutellum chocolate brown, clothed with sparse blackish hairs, the former with three faint dark stripes. Pleura and coxae dark, black haired, the hairs on the antealar callus reddish brown. Femora black, or nearly so, black haired, fore and mid tibiae and tarsi orange brown, with orange and black hairs; hind tibia and tarsi darker. Wings brownish hyaline, first and fourth posterior cells closed and petiolate; a short appendix on the upper branch of the third vein in one specimen, none in the other. Abdomen above dark mahogany brown, entirely clothed with appressed golden rufous hairs, beneath blackish, the golden hairs sparser.

Holotype ♀ and 1 ♀ Paratype from Police Station, upper Pequeni river, Madden Lake, C. Z. Holotype to be deposited in the M. C. Z., Harvard Univ., Cambridge, Mass. There are also 2 ♀, Porto Bello, April 22, 1912 (Busck coll.) in the U. S. Nat. Mus., determined as *Sc. rufescens* Ric. by me in 1938, which are almost certainly the present species.

EXPLANATION OF PLATE I

Fig. 1, a. *Scione albfiasciata* Macq. Sta. Marta, Colombia. 2, a. *Scione maculipennis* Schin. Restrepo, Colombia. 3, a. *Scione claripennis* Ric. El Valle, Panama. 4 a. *Scione aureopygia* sp. nov. Paratype. 5, a. *Scione maculipennis* Schin. Chiriqui, Panama. 6, a. *Scione distincta* Schin. Venezuela. 6 b. *Scione maculipennis* Schin. El Valle, Panama. 7, a, b. *Pityocera festae* Gig.-Tos. Panama. 8, a, b. *Esenbeckia mejiai* sp. nov. Holotype. 9, a, b. *Esenbeckia chagresensis* sp. nov. Paratype.


1a
1
2a
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9b
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This species is exceedingly close to *S. rufescens* Ric., from which it may be distinguished by its smaller size and darker coloring. It shows in the structure of the palpi and antennae a condition approaching the species of the genus *Fidena*, for one of which it might well be taken, except for the closed fourth posterior cell.

Scione claripennis Ricardo

(Figs. 3, a)

1900, Ann. Mag. Nat. Hist., (7) VI, p. 292 (♀; Peru); 1902, Op. cit., IX, p. 435. Surcouf, 1921, Gen. Insect., p. 114. Enderlein, 1925, Mitt. Zool. Mus. Berlin, XI, 2, p. 300. Szilady, 1926, Biol. Hung., I, (7), p. 28. Kröber, 1934, Rev. Ent., IV, 2, p. 233 (Peru, Bolivia, Ecuador, Panama).

Rhinotriclista claripennis Kröber, 1930, Stett, Ent. Zeit., XCI, 2, p. 154, fig. 5.

Rhinotriclista brevipalpis Enderlein, Mitt. Zool. Mus. Berlin, XI, 2, pp. 303–304 (♀; Bolivia). Kröber, 1930, Stett, Ent. Zeit., XCI, 2, p. 155. (=*claripennis* Ric.).

Rhinotriclista strigata Enderlein, 1925, Mitt. Zool. Mus. Berlin, XI, 2, p. 303 (♀; Sta. Inez, Ecuador). Kröber, 1930, Stett, Ent. Zeit., XCI, 2, pp. 152–153, fig. 4.

Scione strigata Kröber, 1934, Rev. Ent., IV, 2, p. 235.

Scione costaricana Szilady, 1926, Biol. Hung., I (7), p. 29, (♀; Turrialba, Costa Rica). Kröber, 1934, Rev. Ent., IV, 2, p. 233.

Rhinotriclista costaricana Kröber, 1930, Stett, Ent. Zeit., XCI, 2, p. 156 (Yungas de Coroico, Bolivia; Sta. Inez, Ecuador).

From the descriptions, it seems impossible to separate the above species, and as I lack any South American material, it is better for the present to use the oldest name. Szilady's description of *costaricana* is somewhat ambiguous, as his key gives the wings unspotted, but his description states that they have brown spots around the cross-veins. Kröber determined specimens as *costaricana*, *claripennis* and *brevipalpis* from Yungas de Coroico, Bolivia. All the species except *costaricana* were described from Bolivia, Peru or Ecuador, and neither Kröber nor Enderlein apparently saw Central American material.

A very well preserved specimen from El Valle, Panama, has the following characters: Length, 11.5 mm. Frons about two times as high as wide, very slightly narrowed at vertex, brown in the middle, whitish at sides. Palpi as figured. Beard yellow. Thorax dark brown, the usual *Scione* stripes distinct, whitish. Pleura mostly dark haired, pre-alar tuft dark, post-alar tuft yellow. Hairs on sides of notum yellowish brown, becoming long, silky and golden on each side of scutellum. Scutellum brown with long erect pale golden hairs. Wings nearly hyaline, the costal and first basal cells yellowish. Legs dark brown, densely black haired, the hind tibiae practically black. Abdomen brown on first two tergites, the remainder nearly black. Sides of first tergite behind with white hairs, a fairly broad white haired hind marginal band on second tergite, and tergites one to five with prominent silvery white median triangles. Tergites 3 to 5 all have small

silvery white tufts at the sides. Beneath the sternites are dark brown, with sparse white hairs at the sides. The second and fifth sternites appear to have entire white haired hind margins. Specimens from Chiriqui, though not well preserved, seem to have more white on the abdomen, in one case complete white bands on tergites 3–6. The palpi are also somewhat broader and blunter.

Panama records: Panama (Kröber). Buena Vista, Chiriqui Mt., 1000 ft. March, 1926, (J. D. Smith). El Valle, Coclé Prov., 2500 ft., Jan. 24, 1941 (G. B. Fairchild).

Scione maculipennis (Schiner)

(Figs. 1, 2, 5 and 6)

Diclisa maculipennis Schiner, 1868, Reise Novara, Zool., II, Abt. 1, Vol. B, Dipt., p. 102, Pl. II, figs. 7, 7a (♀; South America, Venezuela). Osten Sacken, 1886, Biol. Centr.-Amer., Dipt., I, p. 47 (♀; Chiriqui Volcano, 3000–4000 ft., Panama). v. Roder, 1886, Stett, Ent. Zeit., XLVII, p. 262 (Colombia); 1892, Dipt. Gesamm. Sud-Amerika von A. Stubel, p. 8. Hunter, 1900, Trans. Amer. Ent. Soc., XXVII, p. 135. Kertesz, 1900, Cat. Taban., p. 14. Surcouf, 1921, Gen. Insect. Taban., p. 113.

Scione maculipennis Ricardo, 1900, Ann. Mag. Nat. Hist., (7) V, p. 14; 1902, Op. cit., (7) IX, p. 435 (♀; Bogota). Hine, 1925, Occ. Pap. Mus. Zool. Univ. Michigan, No. 162, p. 9 (Boquete, Chiriqui, Panama). Szilady, 1926, Biol. Hung., I, 7, p. 28. Kröber, 1930, Stett. Ent. Zeit., XCI, pt. 2, pp. 144, 165, fig. 10 (♀; Ecuador, Peru, Venezuela, Mexico); 1934, Rev. Ent., IV, 2, p. 234.

Rhinotriclista maculipennis Enderlein, 1925, Mitt. Zool. Mus. Berlin, XI, 2, p. 302.

The identification of Panama material is tentative, as I lack the long series of specimens from neighboring territory necessary for elucidation of the limits of variation of the several forms which have been described. Specimens determined by Dr. Bequaert as *maculipennis* Schin., *albifasciata* Macq., and *distincta* Schin., are before me, and are figured here for comparison. Specimens from Chiriqui province are intermediate between *maculipennis* and *albifasciata* in many respects, while the specimens from El Valle, Coclé province, is the same as *distincta* in the proportions of the frons, though the palpi are rather different. The general color of the Panama material is rather brown, the beard yellowish and the legs dark brown, thus more like *maculipennis*, but more yellowish than *albifasciata*. The balance of the evidence seems to place the material nearest to *maculipennis*.

Specimens examined: 1 ♀, Restrepo, Dept. Meta, Colombia, 1936, (J. Bequaert coll.), (*maculipennis*) (Figs. 2, a). 1 ♀, N. W. Sierra N. de Sta. Marta, Colombia, 7000–8000 ft., July 21, 1928. (P. J. Darlington coll.), (*albifasciata*) (Figs. 1, a). 1 ♀, Aragua, Venezuela, Sept. 8, 1936 (*distincta*) (Figs. 6, a).

Panama records: Volcan de Chiriqui, (Osten Sacken). Boquete, Chiriqui, March, 1923 (Hine). 1 ♀, El Valle, Coclé prov., Jan. 24, 1941. 2 ♀ Rio Chiriqui Viejo, Llanos de Volcan, Chiriqui Prov., 7–7500 ft., Jan., 1939, (P. Allen coll.). 1 ♀, Boquete, Chiriqui, Jan., 1941. 5 ♀, Cerro Punta, Chiriqui, 6–7000 ft., Feb.-March, 1940.

Genus **Esenbeckia** Rondani

1863, Arch per la Zool., Modena, III, p. 83 (type by original designation: *Silvius vulpes* Wiedemann, 1828). Lutz, 1909, Zool. Jahrb., Suppl. X, pp. 625, 627, 661. Enderlein, 1925, Mitt. Mus. Berlin, XI, 2, p. 287. Kröber, 1931, Zool. Anz., XCIV, p. 245; 1932, Rev. Ent., II, 1, p. 82. Borgmeier, 1933, Rev. Ent., III, 3,p. 292. Kröber, 1934, Rev. Ent., IV, 2, p. 240.

Dyspangonia Lutz, 1905, Rev. Soc. Sci. Sao Paulo, I, 1, pp. 22, 27; 1906, Soc. Sci. Sao Paulo (separate publication), p. 3. Bequaert, 1924, Psyche, XXXI, 1, p. 28. (Type *Pangonia fuscipennis* Wied., 1828). Borgmeier, 1933, Rev. Ent., III, 3, p. 291.

Esenbackia Surcouf, 1909, Bull. Mus. Hist. Nat. Paris, XV, p. 257. (lapsus).

Kröber (1934) lists 30 species and 6 varieties as belonging to the genus, of which but 5 are said to occur in Central America. Of these I recognize 3 in the material before me, *prasiniventris* Macq., *translucens* Mac. and *illota* Will., the first two from Panama. Kröber's record of *filipalpus* Will. from Costa Rica needs confirmation, as the species was described from Paraguay. *E. fuscipennis* var. *minor* Kröber from Costa Rica I have not seen.

The four species I have taken in Panama are none of them rare, but all seem to have quite short seasons of flight. *Prasiniventris* is the most abundant and widespread, and flies throughout the day. *Translucens* and *chagresensis* are more or less crepuscular, while *illota osornoi* is strictly crepuscular and nocturnal. In addition, I have added the description of an apparently new species from Honduras.

The genus as found in Panama may be characterized as follows: Eyes bare. Ocelli present. Frons with or without a bare frontal callus, often secondarily denuded. Face pollinose, rarely shining, flat or somewhat inflated, not snout-like. Antennae with first two segments short, the first at least twice as long as the second. Third segment of eight annuli, the first four tending to become fused, the last slender and spike like. Palpi about half length of proboscis, slender, curved, and flattened. Proboscis equalling or somewhat exceeding head height, the theca of the labium and the labella with shiny sclerotized plates, the latter one-third to one-fifth the length of the proboscis. Wings with subepaulet without macrotrichia, the costa and first longitudinal vein above and the costa beneath with macrotrichia, other veins all bare.

First posterior cell closed and usually petiolate. Upper branch of third vein with a moderate to long appendix. Legs slender, short haired, the mid and hind tibiae with a pair of well marked apical spurs. Abdomen moderately slender to rather broad.

KEY TO FEMALES

1. Wings heavily fumose. Body and legs largely black.....2
   Wings hyaline or greyish. Body and legs not black.....3
2. Mesonotum and scutellum orange brown, with orange pubescence. . **translucens**
   Mesonotum and scutellum blackish, with black hairs and grey pubescence, **chagresensis**
3. Thorax and abdomen concolorous, pale yellowish brown. Palpi slender, sharp pointed. No tufts of white hair on sides of abdominal tergites 3 to 5, **illota osornoi**
   Thorax purplish brown, abdomen deep jade to light yellowish green in life, fading in long preserved specimens to yellowish. Palpi slender, blunt pointed. Fairly prominent tufts of white hairs on sides of tergites 3–5, **prasiniventris**

Esenbeckia translucens (Macquart)

(Figs. 15, a, b)

Pangonia translucens Macquart, 1845, Mem. Soc. Sci. Lille (1844), p. 154, Pl. III, fig. 5 (♀; Brasil); 1846, Dipt. Exot., Suppl. I, p. 26, Pl. III, fig. 5. Walker, 1854, List Dipt. Brit. Mus. V, Suppl. 1, p. 130. Rondani, 1863, Arch. per la Zool., Modena, III, 1, p. 85. Kertesz, 1900, Cat. Taban., p. 24. Hunter, 1900, Trans. Amer. Ent. Soc., XXVII, p. 134. Ricardo, 1900, Ann. Mag. Nat. Hist., (7) V, p. 171. Hine, 1920, Ohio Journ. Sci., XX, No. 8, p. 312 (♀; Ecuador, Panama, Guatemala); 1925, Occas. Pap. Mus. Zool. Univ. Michigan, No. 162, pp. 4, 7.

Esenbeckia translucens Lutz, 1909, Zool. Jahrb., Suppl. X, p. 670. Surcouf, 1921, Gen. Insect., Taban., p. 115. Enderlein, 1925, Mitt. Mus. Berlin, XI, 2, p. 288. Kröber, 1931, Zool. Anz., XCIV, p. 249; 1932, Rev. Ent., II, 1, p. 71, fig. 19 (♂, ♀; Ecuador, Brasil, Peru); 1934, Rev. Ent., IV, 2, p. 243.

Pangonia fusiformis Walker, 1850. Insect. Saund., I, Dipt., p. 19 (♀; "North America" [Mexico according to Ricardo]); 1854, List Dipt. Brit. Mus., V, Suppl. 1, p. 95. Ricardo, 1900, Ann. Mag. Nat. Hist., (7) V, pp. 169–170. Kertesz, Cat. Taban., p. 19. Surcouf, 1921, Gen. Insect., Taban., p. 128.

Phyrla fusciformis Enderlein, 1925, Mitt. Mus. Berlin, XI, 2, p. 394.

This species is probably not uncommon at suitable localities and at the right season, but I have happened to find the right combination only once, on Cerro Azul. It differs from its nearest congener, *E. diaphana* (Schiner) in having nearly wholly black legs. The rufus thorax will quickly distinguish it from *E. chagresensis*.

Distribution: Recorded in the literature from Mexico, Guatemala, Panama, Ecuador, Brasil and Peru. Dr. Bequaert has material from Colombia also. Specimens in the Hine coll. from Cabima, Panama and Cayuga, Guatemala are labelled *Buplex fusiformis* Wlk.

Panama records: 33 ♀ Canal Zone, Cabima, Boqueron River, and Alhajuela (A. Busck coll. in U. S. N. M.). 1 ♀ Summit, C. Z., June, 1930 (Dunn). 2 ♀; New San Juan, Chagres River region, June 26, 1939; 6 ♀, June 28, 1939. 1 ♀

El Valle, Coclé province, 2–2500 ft. July 9, 1939. 11 ♀ Cerro Azul, near Pacora, Panama province, 2000 ft., May 17, 1941. 2 ♀ Cano Saddle, Gatun, C. Z., June 13, 1923 (R. C. Shannon).

Esenbeckia chagresensis sp. nov.

(Figs. 9, a, b)

Female—Length 16–18 mm., of wing 16–18 mm. Eyes bare, dull greenish black in life.

Frons yellowish grey pollinose, about five times higher than wide, widened at base and vertex, the basal suture obsolete. The frontal callosity in well preserved examples is represented by a slightly raised stripe from base to vertex covered with darker and more yellowish pollinosity. This stripe is broader at base, where it flattens out and runs down over the subcallus to the base of the antennae, and in rubbed specimens the upper and middle portions may become denuded, showing a more or less uneven shiny strip. The ocelli are prominent and yellow. Antennae orange yellow. The first segment somewhat inflated, the second small and produced in a short blunt tooth dorsally, both with numerous black hairs, which form an even apical fringe on the second segment. Third segment of eight visible divisions, the first forming a broad basal piece with the following three, which are progressively smaller, while the last four form a sort of style. The fourth division is markedly the smallest, while the terminal piece is spike-like, as long or longer than the previous four divisions together. Clypeus and genae dark grey pollinose, with some dark hairs and light hairs forming tufts near the insertion of the palpi and along the genal margin of the eye. Genae with a deep groove running from the insertion of the palpi to a point even with the insertion of the antennae. Palpi black, curved, broad, blunt pointed, longer than antennae and clothed with black hairs on the inner surface, edges, and basal one-fifth of the outer surface. The inner surfaces of the palpi are round in cross section, the outer bare surfaces flat. Proboscis black, shiny, about equal to head height, the labella and theca of the labium both entirely sclerotized, the former a little less than one-half length of latter.

Mesonotum chocolate brown, covered with white pollen giving it a purplish cast, and with sparse black hairs. Pleura and sternum dark grey with white hairs. Scutellum concolorous with mesonotum. Prescutellar lobe prominent. Subepaulet subtriangular, thin, scale-like, without macrotrichia. Costa and first vein above and beyond arculus with macrotrichia, other veins bare. First posterior and anal cells closed and petiolate, a moderate appendix on the upper branch of the

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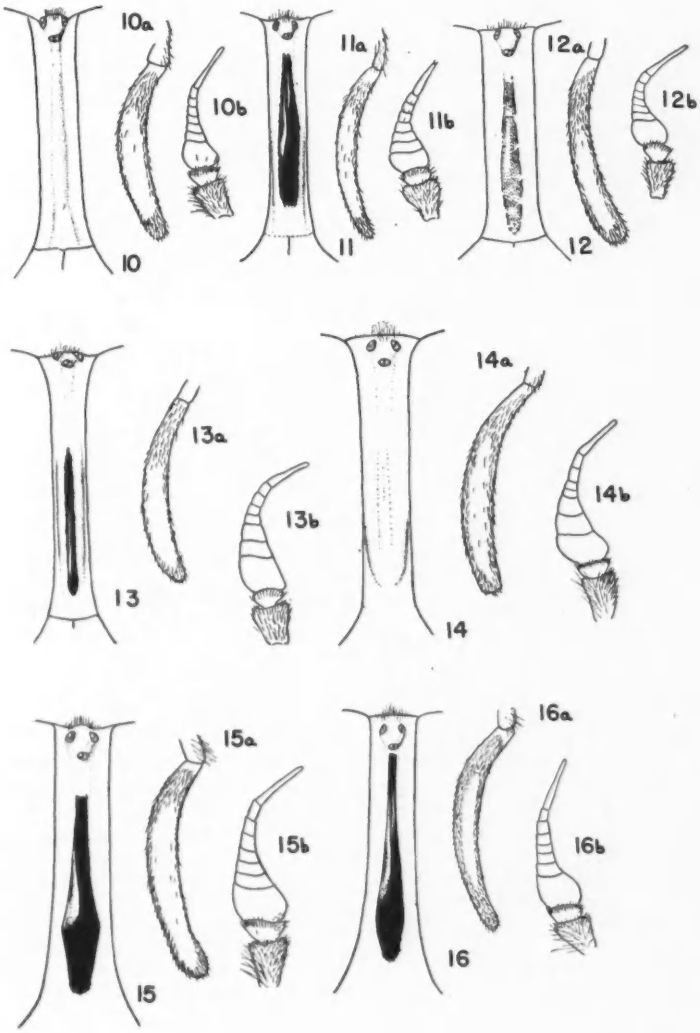
EXPLANATION OF PLATE II

10, a, b. *Esenbeckia illota* Will. Honduras. 11, a, b. *Esenbeckia illota osornoi* subsp. nov. Paratype, Panama. 12, a, b. *Esenbeckia illota enderleini* Krŏb. Goyaz, Brasil. 13, a, b. *Esenbeckia illota guianense* subsp. nov. Holotype, Bartica, British Guiana. 14, a, b. *Esenbeckia illota meridionale* subsp. nov. Holotype, Ilheus, Bahia, Brasil. 15, a, b. *Esenbeckia translucens* Macq. Panama. 16, a, b. *Esenbeckia prasiniventris* Macq. Panama.


10a
10b
10
11a
11b
11
12a
12b
12
13a
13b
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14a
14b
14
15a
15b
15
16a
16b
16

third vein. Whole wing deeply fumose. All legs entirely black with black hairs. Coxae white haired.

Abdomen: First tergite straw yellow, translucent, with white hairs on the lateral and posterior margins, black hairs in a small patch on each side of the scutellum. Second tergite varying from clear yellow with a small brown spot on each lateral margin to entirely black. Succeeding segments black. All tergites with narrow light hind margins which bear white hairs, while the yellow or black anterior four-fifths of the segments bear black hairs. Venter: First two or three sternites largely yellow with lateral black patches, or entirely black with light hind margins. Fourth to terminal sternites black with light hind margins.

Holotype ♀ and many ♀ paratypes from New San Juan, in the Chagres River valley between Gamboa and Madden Dam, C. Z., June 26, 1939, on horse. 1 ♀ paratype from Rio Frio, Magdalena, Colombia, October 15, 1927. (Geo. Salt. coll. in Dr. J. Bequaert's collection). 1 ♀ Paratype, Utevey, near Pacora, Aug. 6, 1941. 25 ♀ Paratypes, Moja Polla, Chagres river region, June 12, 24, July 8, 1940; June 15, 1941. Holotype and 5 Paratypes to be deposited in the M. C. Z., Harvard Univ., Cambridge, Mass. Remaining Paratypes in the author's collection.

Esenbeckia illota (Williston)

(Figs. 10 to 14)

Pangonia illota Williston, 1901, Biol. Centr.-Amer., Dipt., I, p. 254 (♀; Ruatan Island, Rep. Honduras). Aldrich, 1905, Cat. North Amer. Diptera, p. 193. Kertesz, 1908, Cat. Dipt., III, p. 155.

Pangonius illota Surcouf, 1921, Gen. Insect., Taban., p. 128. Hine, 1925, Occas. Papers Mus. Zool. Univ. Michigan, No. 162, p. 5.

Esenbeckia illota J. Bequaert, 1932, Jl. New York Ent. Soc., XXXIX, (1931), p. 536 (♀); 1933, Publ. No. 431, Carnegie Inst. Washington, p. 560 (♀). Kröber, 1934, Rev. de Entomologia, IV, pt. 2, p. 242.

Pangonia ferruginea Macquart, 1839, (Not of Meigen, 1804. See below). Mem. Soc. Sci. Agric. Lille (1838), Pt. 3, p. 295, (♀; northern part of the Capitainerie of Sao Paulo, Brasil); 1838, Dipt. Exot., I, pt. 2, p. 179. Walker, 1854, List Dipt. Brit. Mus., V, Suppl. 1, p. 129. Ricardo, 1900, Ann. Mag. Nat. Hist., (7) V, p. 171. Hunter, 1900, Trans. Amer. Ent. Soc., XXVII, p. 134. Kertesz, 1900, Cat. Taban., p. 18; 1908, Cat. Dipt., III, p. 154.

Dyspangonia ferruginea Lutz. 1905, Rev. Soc. Sci. Sao Paulo, No. 1, p. 28 (Goyaz, August).

Esenbeckia ferruginea Ad. Lutz, 1909, Zool. Jahrb., Suppl. X, pt. 4, p. 667, Pl. III, fig. 45 (♀; Amaro Leite and Rio dos bois, Est. Goyaz; also Est. Minas Geraes). Ad. Lutz and Neiva, 1909, Mem. Inst. Osw. Cruz, I, pt. 1, p. 32 (Bicudos, Est. Minas Geraes). Neiva and Penna, 1916, Mem. Inst. Osw. Cruz., VIII, pp. 93 and 97 (Formosa, Est. Bahia; Parnagua, Est. Piauhy). Surcouf, 1921, Gen. Insect., Tabanidae, p. 115 (Brasil). J. Bequaert, 1925, 13th Rept. United Fruit Co. Med. Dept. for 1924, p. 15. Kröber, 1934, Rev. de Entomologia, II, pt. 1, p. 65, fig. 11 (♀; Venezuela).

Esenbeckia enderleini Kröber, 1931, Zool. Anz., XCIV, p. 252, fig. 2 (♂; Tucuman, Argentina); 1932, Rev. Ent., II, 1, p. 64; 1934, Op. cit., IV, 2, p. 241 (♂, ♀; Argentina, Brasil).

Not *Tanyglossa ferruginea* Meigen, 1804, Klass. Zweifl. Insekt., I, p. 175, Pl. 10, fig. 2 (Spain ?).

Not *Pangonia ferruginea* Latreille, 1809, Gen. Crust. et Insect., IV, p. 282. Meigen, 1820, Syst. Beschreib. Europ. Zweifl. Insekt., II, p. 24. Walker, 1854, List. Dipt. Brit. Mus., V, p. 118. Loew, 1856, Neue Beitr., VI, p. 28. Schiner, 1868, Novara Reise, Zool., II, Abt. 1, Vol. B, Dipt., p. 99 (♂; Gibraltar). Ricardo, 1900, Ann. Mag. Nat. Hist., (7) V, p. 181 (♂; France). Kertesz, 1900, Cat. Taban., p. 18. Villeneuve, 1905, Ann. Ent. Soc. France, LXXIV, p. 309. Arias, 1915, Dipt. Espana, No. 19, p. 60. Enderlein, 1925, Mitt. Mus. Berlin, XI, 2, p. 286, 287.

The group to which this species belongs seems to be in a considerable nomenclatorial tangle, and the material available has not shed much light on the matter. *E. ferruginea* Macq., described from "au Nord du capitainerie de St. Paul," is represented by a considerable series of specimens from Anapolis, Goyaz and 2 ♀ from Abuna, Matto Grosso, Brasil, which I consider to be true *ferruginea*. *E. illota* Will., described from Ruatan Is., Rep. Honduras, I have from Prieta, Rep. Honduras. These two forms are quite distinct, though obviously related. Specimens from localities between these northern and southern limits appear to differ in slight details of color and structure from both *illota* and *ferruginea*, and to differ among themselves sufficiently for three types to be distinguishable, which I consider to be races or subspecies which serve to connect the two end forms. The accompanying figures will serve to show the main structural differences between the various forms, while the slight color differences are described below. As shown above, *ferruginea* Macq., 1838 is apparently a homonym of *ferruginea* (Meig.), which leaves *illota* Will. as the earliest available name for the group, and the others are all considered to be subspecies of it.

Esenbeckia illota illota Will.

Frons, antenna and palpus as figured. Whole insect pale brown. Mesonotum clothed with yellowish brown hairs and greyish pubescence. Pleura paler, the hairs more yellowish. Beard sparse, creamy. A tuft of brown hairs on the genae at the lower corner of the eye, and a row of brown hairs along the anterior eye margin bordering the face. Antennae and palpi pale yellowish orange, the hairs on the palpi black those on the basal antennal segments dark brown. Legs yellow, orange haired. Abdomen yellowish brown, horn colored, the first tergite markedly lighter. Hairs on first tergite pale yellowish, those on remaining tergites reddish brown. Each tergite with a small tuft of pale hairs at the extreme latero-posterior angle. First sternite pale haired, the rest dark haired with narrow posterior fringes of pale hairs. Knob of haltere pale yellow.

Described and figured from a female from Prieta, Rep. Honduras, May 5, 1924 (J. Bequaert coll.). Recorded in the literature from Yucatan, Honduras and British Honduras.

Esenbeckia illota osornoi subsp. nov.

Frons, antenna and palpus as figured. Differs from the typical form in more orange antennae, sparser beard, thorax more yellowish, first tergite not paler than the others, all tergites orange haired, no pale lateral tufts, sternites all orange haired and knob of haltere orange brown. Specimens before me seem also to be smaller and more slender than the few *illota* I have seen.

Holotype ♀ and 45 ♀ Paratypes, Moja Pollo, Chagres River Valley, Jan., Feb., and March, 1940. 1 ♀ Paratype Canal Zone Forest Reserve, Feb. 22, 1942. Other Paratypes Boca de Cupa, Darien Province, Panama, March, 1939; Barro Colorado Is., C. Z., March, 1934; Puerto Armuelles, Chiriqui Province, January, 1940; Juan Mina Station, Chagres River valley, Feb. 17, 1939. 1 ♀, Restrepo, Colombia (P. C. A. Antunes coll.). There is also a considerable number of specimens from various localities in Colombia in Dr. Bequaert's collection, which are unfortunately not before me, although I have examined them.

There are also 2 ♀ in the Hine coll. from San Mateo, Costa Rica, and Crystalina, Colombia, labelled *Buplex tenuirostris* Walk., a name placed as a synonym of *Ricardoa flavohirta* (Bell.) by Kröber, but which appear to be the same as my Panama specimens.

Esenbeckia illota guianense subsp. nov.

Frons, antenna and palpus as figured. Coloration practically as in *osornoi*, but rather darker and more reddish throughout. Hairs on palpi and basal antennal segments definitely rufous. Proboscis apparently thicker and heavier than in *osornoi*.

Described and figured from the Holotype, a ♀ from Bartica, British Guiana, June 6, 1901. 1 ♀ Paratype, Caura Valley, Venezuela.

Esenbeckia illota meridionae subsp. nov.

Frons, antenna and palpus as figured. Coloration much as in the preceding two forms, but differing as follows: Antennae pale yellow, hairs on basal segments and on palpi rufous. Beard rather heavy, creamy white. Tufts of paler hairs present on the latero-posterior margins of the tergites. Sternites with wholly pale straw colored hairs. Knobs of halteres dark brown, contrasting strongly with the pale pedicels.

Description and figures drawn from the Holotype, a female from Ilheus, Bahia, Brazil, August 30, 1934. I have seen other material from the same locality, but its distinctness was not then recognized.

Esenbeckia illota enderleini Kröb.

Frons, antenna and palpus as figured. Coloration in general rather paler than the preceding forms. Antennae ivory white, the hairs on the basal segments yellow. Hairs on palpi black. Beard sparse, nearly white. Hairs on thorax and abdomen, both above and below, pale straw colored, and rather denser and longer than on the other forms. In addition, many specimens bear faint median dark integumentary spots or streaks on the second to fifth tergites, and occasionally dorso-lateral spots of the same nature on the 3rd, 4th and 5th tergites can be made out.

Description drawn from a female from Pyrenopolis, Goyaz, Brazil, Aug. 10, 1936 (A. N. Allen coll.). I have seen material of this form from the States of Goyaz, Matto Grosso and Sao Paulo, Brasil. Kröber considered the form from Venezuela to be true *ferruginea*, while *enderleini*, described from the male from Tucuman, Argentina, he later records also from Brasil. The characters he uses to separate the two species (1932) are just those here used, while his figure of *ferruginea* agrees fairly well with my material from British Guiana and Venezuela. *Esenbeckia ferruginea* var. *nigrovillosa* Kröb., of which I have specimens from Goyaz, Brasil, determined by Dr. O. Castro, appears to be a distinct species, as the proboscis is quite different in structure, the theca of the labellum greatly inflated and heavily sclerotized, the labella large and also heavily sclerotized.

Esenbeckia prasiniventris (Macquart)

(Figs. 16, a, b)

Pangonia prasiniventris Macquart, 1845, Mem. Soc. Sci. Lille, (1884), p. 161, Pl. III, fig. 9; 1846, Dipt. Exot., Suppl. 1, p. 29, Pl. III, fig. 9 (♀; Colombia). Walker, 1854, List. Bipt. Drit. Mus., V, Suppl. 1, p. 130. Rondani, 1863, Arch. per la Zool., Modena III, 1, p. 85. Schiner, 1868, Novara Reise, Zool., II, Abt. 1, Vol. B, Dipt., p. 101 (♀, ♂). Osten Sacken, 1886, Biol. Centr.-Amer., Dipt., I, p. 45 (♂; Panama). Ricardo, 1900, Ann. Mag. Nat. Hist., (7) V, p. 173. Hine, 1917, Trans. Amer. Ent. Soc., XLIII, p. 291 (Guatemala, Costa Rica, Ecuador, British Guiana). Dunn, 1934, Psyche, XLI, p. 171 (Panama).

Pangonia prasiventris Hunter, 1900, Trans. Amer. Ent. Soc., XXVII, p. 134, (lapsus).

Pangonius prasiniventris Hine, 1925, Occ. Papers Mus. Zool. Univ. Michigan, No. 162, p. 5 (Honduras, Guatemala).

Esenbeckia prasiniventris Lutz, 1909, Zool. Jahrb., Suppl. X, 4, p. 670 (♂, ♀); 1911, Mem. Inst. Osw. Cruz., III, p. 84. Surcouf, 1921, Gen. Insect., Taban., p. 84. Kröber, 1931, Zool. Anz., XCIV, pp. 246–247; 1932, Rev. Ent., II, p. 55, figs. 3–4; 1934, Rev. Ent., IV, 2, p. 242. Bequaert, 1924, 13th Ann. Rep. Med. Dept. United Fruit Co., p. 205; 1940, Bull. Ent. Res., XXX, 4, p. 448. Lutz, 1928, Est. Zool. Parasit., Venezolanas, p. 56. Enderlein, 1925, Mitt. Mus. Berlin, XI, 2, p. 288. Curran, 1934, N. Amer. Dipt., p. 152, fig. 25 (head), p. 153, fig. 29 (wing).

Esenbeckia semiviridis Kröber, 1931, Zool. Anz., XCIV, p. 247; 1932, Rev. Ent., II, 1, p. 57, figs. 5–6; 1934, Rev. Ent., IV, 2, p. 242 (Venezuela).

Not *Pangonia semiviridis* Ricardo, 1900, Ann. Mag. Nat. Hist., (7) VIII, p. 181, Pl. I, fig. 7 (♂; Barengo, Old Castile [Spain]).

There is considerable variation in this species, the ground color of the abdomen ranging from deep jade green to light yellowish green, while the vestiture of the thorax may be largely grey or quite rufous. The males are generally yellower and paler than the females.

Prasiniventris is the most abundant species of the genus in Panama, but like the other species its season of flight is rather short, from about the middle of December to the middle of February. During this period, however, it assumes almost epidemic proportions, and is a severe pest to stock, even attacking man. The flight is swift and noisy, and the flies are not easily discouraged, returning again and again to the attack.

Distribution: Recorded in the literature from Guatemala, Honduras, Costa Rica, Panama, Colombia, Ecuador, Venezuela, British Guiana, Trinidad and Brasil (Minas Geraes). I also have specimens from Stann Creek, Brit. Honduras, Feb. 19, 1940 (Komp coll.).

Panama records: Camp La Vaca, Chiriqui, Feb., 1930 (Dunn). David (Osten Sacken). Buena Vista, Chiriqui, 1000 ft., March, 1926 (J. D. Smith). El Valle, Coclé Prov., Dec. 8, 1938; Dec. 10, 17, 1939; Jan. 24, 1941. Taboga Is., Dec. 18, 1938. Ft. Clayton, C. Z., Jan. 23, 1939. Chepo, June 19, 1930 (Dunn). Summit, C. Z., Dec. 21, 1929 (Dunn). Utevey, near Pacora, Aug. 6, 1941. Also a long series from Moja Pollo, on the Chagres River and the C. Z. Forest Reserve along Madden Road, at various dates in Dec., Jan., and Feb. Ancon, C. Z. (Dunn). Paraiso, C. Z., Jan. 16, 1911 (Busck).

Esenbeckia mejiai sp. nov.

(Figs. 8, a, b)

Female—Length 15 mm., of wing, 16 mm.

Frons about seven times as high as wide, yellowish grey pollinose, the callus brown. Ocellar tubercle and subcallus dusky pollinose. Fronto-clypeus rather strongly inflated, shiny yellow. Genae shiny yellow, yellow pollinose towards the eye margins. Beard sparse and short, dusky brown. Antennae orange, the basal segments black haired, the terminal annulus unusually long and slender. Palpi orange, black haired, the apex drawn out in a slender point. Proboscis longer than head height, the labella less than one-fifth its length, and apparently well sclerotized.

Mesonotum greyish brown, clothed with yellowish brown and dark grey hairs. Scutellum concolorous. Pleura more yellowish. Wings greyish fumose, the costal and basal cells yellowish. First posterior cell closed and short petiolate, third vein with a long appendix. Legs orange brown, coxae and at least bases of femora black haired.

Abdomen dirty yellowish, horn colored. First tergite yellowish haired, second and succeeding tergites black haired anteriorly, but with long, pale straw colored hairs on the hind margins. These pale hairs become more abundant laterally, where they cover practically the width of the segment, and on the terminal segments they practically replace the dark hairs. Venter wholly yellowish and pale haired.

Holotype ♀ Tegucigalpa, Rep. of Honduras, November, 1941. (Dr. I. Mejia coll.). To be deposited in the Museum of Comparative Zoology, Cambridge, Mass. This species much resembles *illota* and its allies in coloration, but the structure of face, antennae and palpi is entirely distinct. It is the only shiny faced species of the genus I have seen.

EXPERIMENTAL EMBRYOLOGY, (A MANUAL OF TECHNIQUES AND PROCEDURES), by ROBERTS RUGH. Pages i-vi and 1-302, 72 pages of figs. 1941. Mimeograph, spiral back, card cover, 8½ x 11 inches. Published by NEW YORK UNIVERSITY BOOKSTORE, 18 Washington Place, New York. Price, $3.00.

While this laboratory guide is almost wholly based on vertebrate material we call attention to it because it is the most complete guide on embryology that we have seen. It is a volume that would be of great use to students following the experimental procedures of such workers in the realm of vertebrate embryology as Spemann, Waddington and Paul Weis. We believe that it can be of much use in any laboratory where work on insect embryology, especially of an experimental nature, is carried on.

The table of contents is the only key to the volume as there is no index. Following a list of about forty "Reference Books for Experimental Embryology" the contents are divided as follows:

BASIC PROCEDURES (including) General operative procedure, Histological hints: EXPERIMENTS ON THE EGG (including) Artificial parthenogenesis, Androgenesis, the Amphibian germinal vesicle: FERTILIZATION (including) Physiology of, Hybridization and early development: ENVIRONMENT AND EARLY DEVELOPMENT (including) Effect of environmental constituents, Temperature and the developmental rate, Heteroploidy from low temperatures, Effect of pressure, Effect of gravity, Effect of thyroid and iodine: OPERATIVE PROCEDURES (including) Cell movements and vital staining, Parabiosis and Telobiosis, Chimeras, Culturing of isolated tissues, Limb-field and other field operations, Organizer and development: INVERTEBRATE MATERIAL (including) Artemia, Daphnia, Tubifex, Enchytrea, Introduction to experimental method using Planaria: FISH MATERIAL: CHICK MATERIAL.

Following the above body of the work are pages 264-267 on Biophotography, pages 268-275 on equipment, companies selling the same, solutions and reagents, instruments, etc. Pages 277-302 are occupied by a glossary of embryological terms, one of the most extensive we have seen.

Having reviewed many works on microtechnique in our own teaching we are very favorably impressed with this laboratory guide. It is crowded from cover to cover with information of great value to experimentalists on vertebrate material and has many procedures which could be of use to experimenters on insect eggs but more particularly on insect larvae and pupae. The insect egg itself offers extreme difficulties because of its very protective hard chorion.

Professor Roberts Rugh is teacher of embryology at the Washington Square College (New York) of New York University. He is a graduate of Oberlin College (A.B. and A.M.) and of Columbia University (Ph.D.). This handy volume represents experience.—C. H. K.

A NEW GENUS (PLUMERELLA) AND A NEW SPECIES OF GRASS FEEDING LEAFHOPPER FROM MEXICO

DWIGHT M. DELONG,
Ohio State University,
Columbus, Ohio

The specimens from which the following genus and species are described seem to live at a quite definite and limited ecological range. They occur only in the alpine flora at altitudes of 10,000 to 10,500 feet in the tropical portion of the Sierra Madre Mountains. A large series of specimens were collected from tall, thick tufts of bunch grass growing under the pines and firs on the slopes at the tops of the range at Rio Frio, some 30 miles from Mexico City. Extensive collecting at different altitudes and in many associations indicates that this species occurs only at this altitude and under these specific conditions.

Genus **Plumerella** N. G.

In general appearance resembling *Draeculacephala* and closely related to it. Vertex more elongate and tubular, the upper surface is convexly rounded from the lateral margins, not depressed, evenly sloping from anterior portion of pronotum to blunt apex. Ocelli minute, on posterior portion of vertex, three-fourths the distance from apex to pronotum Face long, contour almost straight in profile or slightly concave from apex of vertex to clypeus. Body elongate, narrow, elytra without reticulate cross veins at apex.

Genotype, *alpina*, n. sp.

At the present time specimens from which this genus is described are known only from Mexico. Dr. C. C. Plummer assisted in collecting the original series, as well as many other interesting species, and I take pleasure in naming this genus in his honor.

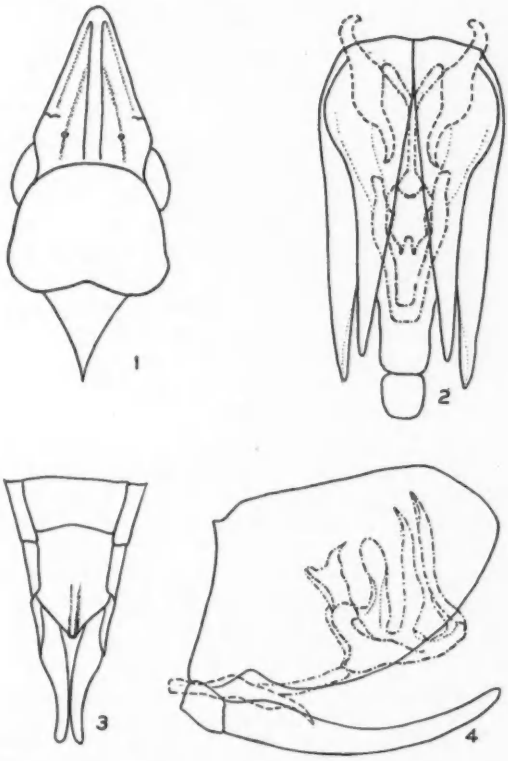
Plummerella alpina n. sp.

(Figs. 1-4)

Superficially resembling a "long nosed" species of *Draeculacephala*. Length, 7.5–9 mm.

Vertex strongly produced, apex blunt, about one-fourth longer on middle than basal width between eyes. Convexly rounded between lateral margins. Margin thick at apex. Ocelli minute, distant from eyes and more than three-fourths the distance from apex to pronotum. Pronotum deeply, broadly notched at middle on posterior margin.

Color.—Dark green, yellow and marked with black. Vertex yellowish, central half sometimes rusty in color. A pair of proximal narrow black longitudinal lines on middle. In well marked specimens with a pair of longitudinal, divergent lines from apex which are often broken and pass through the ocelli. Pronotum yellow to dark green, usually with black longitudinal lines at margin, a longitudinal line at middle, and one on outer margin either side of darker median color band. Scutellum



Plummerella alpina. 1. Dorsal view of head and pronotum. 2. Ventral view of male genitalia. 3. Ventral view of apical portion of female abdomen. 4. Lateral view of male genitalia showing aedeagus.

yellow, a pair of small, proximal black dashes just behind margin of pronotum and a proximal pair on disc. Elytra dark green, veins paler but not conspicuous. Face varying from entirely black in the males with a few pale areas on clypeus and lorae, to a broad, black elongate band in females, extending from apex to tip of clypeus. Marginal line on vertex and a few arcs just beneath dark brown to black.

Genitalia.—Female last ventral segment roundedly produced posteriorly and distinctly keeled on middle at apex. Male plates long and slender, triangular with long alternate apices which almost reach the apices of the pygofers. Male styles with apical fourth narrowed, central half broad, and basal fourth narrowed with tip curved inwardly. The aedeagus is a complicated structure with a series of processes extending dorsally from the ventral base. At the anterior end is a pair of short basal processes, between which is another process which is divided apically into two divergent portions which are broadened at their apices; just posterior to this is a tubular structure which is broadly rounded at apex. The two processes which are posterior to the tube are longer and have pointed apical tips, the posterior of the two being slightly longer.

Holotype male, allotype female and male and female paratypes from Rio Frio, Mexico, D. F., October 7 and 18, 1941, collected by C. C. Plummer, J. S. Caldwell, E. E. Good and the author, in the author's collection, and paratypes in the U. S. National Museum collection. A series of specimens are also at hand labeled "Mexico" and kindly loaned for study by Dr. Edward S. Ross, Assistant Curator of Insects at the California Academy of Sciences. These have been made paratypes and are deposited in the insect collection of that institution.

AN ILLUSTRATED CATALOGUE OF THE PALEARCTIC MELITAEA (LEP. RHOPALOCERA), by L. G. Higgins, MA., F.R.C.S. One hundred ninety pages, 215 text figures, 7 maps and 16 plates of 12 butterflies each, in color, 1941. 7 x 10¼ inches, paper bound. Published in the Transactions, Royal Entomological Society of London, Vol. 91, Part 7. Pp. 175–365. Price 4£–0s–0d.

We wish to call attention to the beautifully illustrated monograph of the Melitaea butterflies by L. G. Higgins which is just off the press in London. We wish to remind our readers that this very night, parts of Singapore are being cleared for the final fight before that world citadel. The dogged determination of the English to carry problems through to a monographic finish despite all opposition and all necessary sacrifice may yet bring comfortable peace. But we wander.

The text figures are line drawings of male genitalia. The plates in color show the body and upper surface of the left wings with the under surface of the left wings reversed and in place of the right wings. One hundred ninety-two such colored drawings made by the artist, Miss Dorothy Fitchew, are used. To the average lover of butterflies the colored plates are the thrilling part of the work. To the specialist the careful work done in allocating all the named varieties and aberrations to the proper species, their distribution, whether they are first or second generation forms, are confined to one sex or occur in both sexes, are the points of interest.

The author is a famous British medical man, a Fellow of the Royal College of Surgeons. He is a Fellow of the Royal Entomological Society. His recreations are entomology and music. His home is in Woking, Surrey.

As a final nudge we wish to point out that this and other similar publications of the Royal Entomological Society are made possible by the annual fee of two guineas (about $10.00). The publications of our society depend on an annual fee of $4.00.—C. H. K.

AGELENIDAE OF THE GENERA HOLOLENA, NOVALENA, RUALENA, AND MELPOMENE

RALPH V. CHAMBERLIN AND WILTON IVIE,
University of Utah,
Salt Lake City, Utah

In this paper we present the second part of a revisional study of the Agelenid spiders belonging to the group Ageleneae. The first part appeared in the ANNALS of the Entomological Society of America, 1941, Vol. 34. In the present paper, we treat the rest of the known North American genera of this group, consisting of *Hololena* Chamberlin and Gertsch, *Novalena*, new, *Rualena*, new, and *Melpomene* Cambridge.

Besides the specimens in the University of Utah collection, we had accesss to a considerable number of specimens from the American Museum of Natural History, kindly loaned to us by Dr. Willis J. Gertsch. Among the latter, were several species which Dr. Gertsch had recognized and labeled as new, but permitted us to use in this revision; these were *Hololena pearcei*, *Rualena alleni* and *cockerelli*, and *Melpomene plesia* and *chiricana*.

We have followed the method of presentation used in the earlier paper. The present location of the specimens referred to is given as near as we know it. The abbreviations used are these: A. M.—American Museum, U. U.—University of Utah, F. M.—Field Museum, M. C. Z.—Museum of Comparative Zoology, Harvard.

While this work is far from complete, it is an attempt to compile what is known of this group, with the hope that it will serve as a basis for future workers in this field.

Genus **Hololena** Chamberlin and Gertsch

Agelena (in part) various authors.
Agelena (subgenus *Hololena*) Chamberlin and Gertsch, Journ. Ent. & Zool., 1929, 21: 105.
Hololena Chamberlin and Ivie, 1935, Bull. Univ. Utah, 26 (4): 31 [Biol. ser. 2 (8): 31].

Typical Color.—Carapace light yellowish brown; with a narrow black seam on each side; a broad brown band along each side above, extending from near the base to the anterior eye row, becoming narrowed on head part; a broad median light band. Chelicerae reddish brown. Endites orange; labium dusky orange; both with narrow whitish tips. Sternum yellowish, with the side margins faintly shaded.

Legs light brownish yellow, with faint dusky annuli. Abdomen dark gray on the sides above, becoming lighter below; with a wide, pale gray, median band above, extending the full length, enclosing a faint dusky lanceolate mark on the basal part, and a faint herringbone pattern on posterior part. Sides specked and streaked; venter pale, with a broken black line along each side, and the whole more or less specked or mottled with darker gray. Spinnerets brownish or dusky orange. Epigastric region pale gray; epigynum reddish brown or yellowish brown.

Typical Structure.—Structure essentially typical for that of the Ageleneae group as a whole. Eyes about equal; order of size A.S., A.M., P.S., P.M.; P.M. eyes about three-fourths of a diameter apart, about one diameter from the side eyes. Chelicerae with two teeth on the hind margin of the fang groove. Tibia-patella IV longer than tibia-patella I, and longer than the carapace, except occasionally in females, where the two are about equal. Spines essentially typcial. Apical segment of hind spinnerets distinctly shorter than the basal segment.

Epigynum typically a rounded basin-like depression, sometimes more or less divided by a median ridge. The openings are in the posterior lateral part of the depression. Just posterior to the depression, or to the side of it, is a pair of short, widely separated spurs. The posterior median sclerite is well developed, extending deep into the genital furrow; the lateral sclerites are well developed, on the surface, but do not extend into the genital furrow, and are fused to the median sclerite.

Palpus.—Femur and patella unmodified. Tibia highly sculptured on the ectal side; there is a flat, pointed, apical process, and a basal lobe, as seen from the ventral view; back of these, on the dorso-ectal aspect, is a deep excavation. The apical process of the tibia has a tooth-like subprocess on the ectal side. The basal lobe consists of a more or less rounded lobe, which bears hairs, and a smooth tongue-like process. The cymbium is short, and the apical process is not extended as in *Agelenopsis* and *Tortolena*. The tegulum is simple, without chitinized extensions. The median apophysis is a small sclerotized, husk-shaped structure. The conductor has an apical process, variously shaped in the different species, and an ectal tail piece, which is largely concealed. The embolus is a short, simple, stylus-like structure, arising on the mesal side and extending medially and distally; usually somewhat twisted. The tip of the embolus is not held by the conductor, but is contained in a large folded fulcrum, which is thin and usually transparent, and arises from near the middle of the ventral side.

Genotype: *Hololena mimoides* (Chamberlin)

This genus consists of a large number of closely related species, found in the western United States and extending into northwestern Mexico. They are very similar in color, and no separation of species is possible on this basis. The epigyna of the females are all of the same general pattern, and in some cases, separation of species on this character alone is difficult, especially since there is often considerable variation of propor-

tions within the species. Size is of little value, since this shows a very wide range, especially among the females of each species; furthermore, there is not much variation in size between the species, this remaining quite consistently between 7 and 11 mm. for length. In the males, the palpus contains the only reliable characters for species determination. The apical process of the conductor and the basal lobe of the tibia, furnishing the best differences, with the median apophysis and the fulcrum also being of some value.

Hololena mimoides (Chamberlin)

(Figs. 1, 2)

Agelena mimoides Chamberlin, 1919, Ann. Ent. Soc. Amer., 12: 256, Pl. 19, ff. 5–6.
Agelena (*Hololena*) *mimoides* Chamberlin and Gertsch, 1929, Journ. Ent. and Zool., 21: 106, Pl. 2, ff. 16–18.

Color normally typical; some specimens paler, with the dark markings faded. Structure typical. Palpus and epigynum distinct.

Measurements:	♂	♀
Length	10.20 mm.	10.40 mm.
Carapace:		
Length	4.70	4.70
Width	3.00	3.30
Tibia-patella:		
I	5.20	4.40
IV	5.75	5.00

Type locality: About W 112° 15′ : N 38° 58′, Filmore Canyon, Utah; ♂ holotype, ♀ allotype. (M. C. Z.)

Known Localities:

109.38 ♀—Moab, Utah; April 19, 1928; J. W. Gertsch. (U. U.)
109.37 ♀—Devil's Canyon, Utah; April 18, 1928; W. J. Gertsch. (U. U.)
111.34 ♀—Oak Canyon, 20 mi. South of Flagstaff, Arizona; April 12, 1935; Wilton Ivie. (U. U.)
112.38 ♀♂—(Type locality).
112.37 ♂ 7♀—Zion Park, Utah. (A. M., U. U.)
113.37 ♀♂—St. George, Utah; 1925, 1926; A. M. Woodbury. (U. U.)
" " ♀—Pintura, Utah; April 15, 1932; Wilton Ivie. (U. U.)
" " ♀—Pine Valley, Utah; June 12, 1934; W. Ivie and H. Rasmussen. (U. U.)

Hololena madera Chamberlin and Ivie, new species

(Figs. 3, 4)

Color and structure typical. Close to *mimoides*; differing in details of the palpus and epigynum.

Measurements:	♂	♀
Length	11.00 mm.	10.80 mm.
Carapace:		
Length	6.00	5.50
Width	4.00	3.50
Tibia-patella:		
I	6.00	4.90
IV	6.70	5.60

Type locality: W 110° 55′ : N 31° 40′, Madera Canyon, Santa Rita Mts., Arizona; ♂ holotype, ♀ allotype, ♂'s ♀s paratypes; September 10, 1941; Wilton Ivie collector.

Hololena atypica Chamberlin and Ivie, new species

(Fig. 5)

Color essentially typical; venter of abdomen not specked; median basal lanceolate mark above moderately distinct. Structure typical, except for the distinctly different form of epigynum.

Measurements:	♀ Holotype
Length	8.00 mm.
Carapace:	
Length	4.00
Width	2.60
Tibia-patella:	
I	3.50
IV	4.00

Type locality: W 105° 16′ : N 40° 2′, Boulder, Colorado; ♀ holotype; May 13, 1937; N. B. Wigutuff collector. (A. M.)

Hololena hola (Chamberlin and Gertsch)

(Figs. 6, 7, 8)

Agelena hola Chamberlin and Gertsch, 1928, Proc. Biol. Soc. Wash., 41: 183. (In part: Holotype, not paratypes.)

Agelena (*Hololena*) *hola* Chamberlin and Gertsch, 1929, Journ. Ent. and Zool., 21: 106.

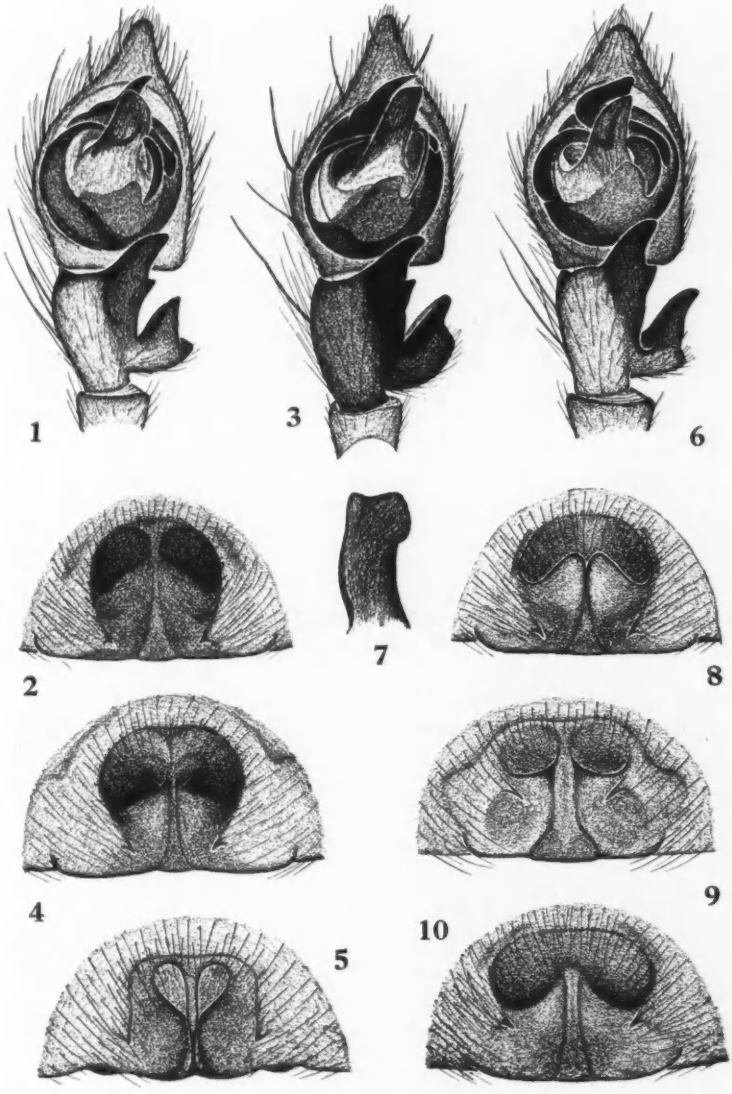
Color and structure typical, with distinct differences in the palpus and epigynum. The epigynum has a wide opening, into which the posterior margin extends; this margin is bilobate, and in some specimens is very asymmetrical. The palpus has a heavy apical process on the conductor, which is flared at the tip.

Measurements:	♂	♀
Length	8.80 mm.	8.00 mm.
Carapace:		
Length	4.30	4.00
Width	3.00	2.70
Tibia-patella:		
I	4.90	3.80
IV	5.50	4.25

Type locality: W 109° 8′ : N 37° 38′, Verdure, Utah; ♀ holotype; April 18, 1928; W. J. Gertsch collector. (U. U.)

EXPLANATION OF PLATE I

Hololena mimoides (Chamberlin). 1. Left palpus, ventral view. 2. Epigynum. *Hololena madera* Chamberlin and Ivie, new species. 3. Left palpus, ventral view. 4. Epigynum. *Hololena atypica* Chamberlin and Ivie, n. sp. 5. Epigynum. *Hololena hola* (Chamberlin and Gertsch). 6. Left palpus, ventral view. 7. Tip of conductor of left palpus, dorso-ectal view. 8. Epigynum. *Hololena hopi* Chamberlin and Ivie, n. sp. 9. Epigynum. *Hololena oquirrhensis* (Chamberlin and Gertsch). 10. Epigynum.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Known Localities:

104.39 ♀—Parker, Colorado; October 10-20, 1934; Chas. A. Wagner. (A. M.)
105.40 2♀—Boulder, Colorado; March 9, 1939, and April 28, 1935; H. G. Rodeck. (U. U.) (A. M.)
105.32 ♂♀—Camp Mary White, New Mexico; August, 1934; Stanley Mulaik. (A. M.)
108.35 ♂s ♀s—Bluewater Lake, New Mexico; September 4, 1941; Wilton Ivie. (U. U.)
108.37 ♀—10 mi. No. Cortez, Colorado; June 17, 1934; Wilton Ivie. (U. U.)
109.37 ♀—(Type locality.)
" " 2♂ ♀—W. Monticello, Utah; September 8, 1933; Wilton Ivie. (U. U.)
109.32 ♂—Graham Mt., Arizona. (A. M.)

Hololena hopi Chamberlin and Ivie, new species

(Fig. 9)

Color essentially typical. Sternum shaded and specked with dusky; very little in the middle, more on the sides. The annuli on the legs fairly distinct below, fainter above. Venter of abdomen distinctly specked.

Structure typical, except the epigynum, which is distinct, as illustrated in Fig. 9.

Measurements:	♀ Holotype
Length	8.50 mm.
Carapace:	
Length	3.55
Width	2.50
Tibia-patella:	
I	3.20
IV	3.65

Type locality: W 112° 35′ : N 34° 24′, About 15 mi. S. W. Prescott, Arizona; ♀ holotype; April 8, 1935; Wilton Ivie collector. (U. U.)

Hololena oquirrhensis (Chamberlin and Gertsch)

(Figs. 10, 11)

Agelena oquirrhensis Chamberlin and Gertsch, 1930, Proc. Biol. Soc. Wash., 43: 142, Pl. 5, fig. 27.

Color and structure typical. Palpus and epigynum as figured.

Measurements:	♂	♀
Length	8.70 mm.	9.30 mm.
Carapace:		
Length	4.10	4.30
Width	2.85	2.90
Tibia-patella:		
I	4.65	4.15
IV	5.00	4.65

Type locality: W 112° 7′ : N 40° 32′, Butterfield Canyon, Oquirrh Mts., Utah; ♂ holotype, ♀ allotype, ♀ paratype; May 25, 1929; Ralph Goodwin collector. (U. U.)

Known Localities:

111.40 ♂ ♀s—Wasatch Mts., Utah, several localities. (U. U.)
112.40 ♂ 2♀—(Type locality.)
112.36 4♀—Jacob Lake, Arizona; June 14, 1934; W. Ivie and H. Rasmussen. (U. U.)
114.42 ♀—Twin Falls, Idaho; April 16, 1932; A. C. Cole. (A. M.)

Hololena nevada (Chamberlin and Gertsch)

(Figs. 12–14)

Agelena (Hololena) nevada Chamberlin and Gertsch, 1929, Journ. Ent. and Zool., 21: 107, Pl. 2, ff. 22–24.

Color and structure typical, with distinctive differences in the palpus and epigynum. The epigynum has a wide depression similar to that of ***hola***, but does not have the posterior margin of the depression bilobate. The male palpus has the apical tip of the conductor heavy, with a deep notch in the end.

Measurements	♂	♀
Length	10.00 mm.	10.00 mm.
Carapace:		
Length	4.70	4.40
Width	3.10	2.93
Tibia-patella:		
I	5.20	4.53
IV	6.00	5.45

Type locality: W 119° : N 39°, Pyramid Lake, Nevada; ♂ holotype (taken from the stomach of a lizard and badly damaged). (U. U.)

Known Localities:

109.38 ♀—Colorado River, 5 mi. N. E. Moab, Utah; May 13, 1933; W. Ivie. (U. U.)
110.39 2♂ 2♀—Price, Utah; 1937; Ross Hardy. (A. M., U. U.)
112.38 2♀—Richfield, Utah; May 17, 1930; W. J. Gertsch. (A. M., U. U.)
" " ♀—Beaver Canyon, Utah; June 7, 1934; W. Ivie and H. Rasmussen. (U. U.)
119.39 ♂ (Type locality.)

Hololena furcata (Chamberlin and Gertsch)

(Figs. 15, 16)

Agelena (Hololena) furcata Chamberlin and Gertsch, 1929, Journ. Ent. and Zool., 21: 107, Pl. 2, 19–21.

Color and structure typical. Epigynum close to that of ***nevada***. Palpus with apical process of conductor more deeply notched than that of ***nevada***, and with the distal fork longer than the posterior.

Measurements:	♂ Holotype	♀ Allotype
Length	8.50 mm.	8.00 mm.
Carapace:		
Length	4.30	4.00
Width	2.80	2.60
Tibia-patella:		
I	4.00	3.45
IV	4.35	3.90

Type locality: W 122° 15′ : N 37° 50′, Berkley, California; ♂ holotype, ♀ allotype, ♂ paratype; J. C. Chamberlin collector. (U. U.)

Known Localities:

121.37 2♀—Castro Valley, Alameda Co., California; March, 1941; W. M. Pearce. (A. M.)
122.37 2♂ ♀—(Type locality.)
" " ♀—Contra Costa Co., California; April 2, 1941; W. M. Pearce. (A. M.)
" " ♂—San Francisco, California. (A. M.)

Hololena frianta Chamberlin and Ivie, new species

(Figs. 17, 21)

Color and structure essentially typical. The epigynum has a very large depression. The male palpus is distinct; the apical process of the conductor is very wide and dentate at the tip.

Measurements:	♂ Holotype	♀ Allotype
Length	8.00 mm.	8.00 mm.
Carapace:		
Length	4.30	4.00
Width	2.80	2.45
Tibia-patella:		
I	4.40	3.80
IV	5.00	4.20

Type locality: W 119° 45′ : N 36° 60′, Friant, California; ♂ holotype, ♀ allotype, ♀ paratype, March, 1913; R. V. Chamberlin collector. (U. U.)

Known Localities:

119.37 2♂—Wawona Camp, Yosemite Park, California; September 17, 1941; Wilton Ivie. (U. U., A. M.)

119.36 ♂ 2♂—(Type locality.)

Hololena pacifica (Banks)

(Figs. 18, 22)

Agelena pacifica Banks, 1896, Journ. N. Y. Ent. Soc., 4: 89.

Agelena curta McCook (in part), Petrunkevitch, 1911, Catalogue, p. 527.

Agelena (*Hololena*) *perita* Chamberlin and Gertsch, 1929, Journ. Ent. and Zool., 21: 107, Pl. 3, ff. 29-30.

Hololena pacifica Chamberlin and Ivie, 1941, Bull. Univ. Utah, 31(8):9 [Biol. ser. 6(3):9].

Color and structure typical. The epigynum has a large depression very similar to that of *frianta*, but has the two spurs closer together than in that species. The male palpus is distinctly different.

Measurements:	♂	♀
Length	10.00 mm.	11.20 mm.
Carapace:		
Length	5.30	5.10
Width	3.50	3.20
Tibia-patella:		
I	5.15	4.60
IV	6.00	5.00

Type locality: W 122° : N 37°, Palo Alto, and Black Mt., California; 3 ♀s. (M. C. Z.)

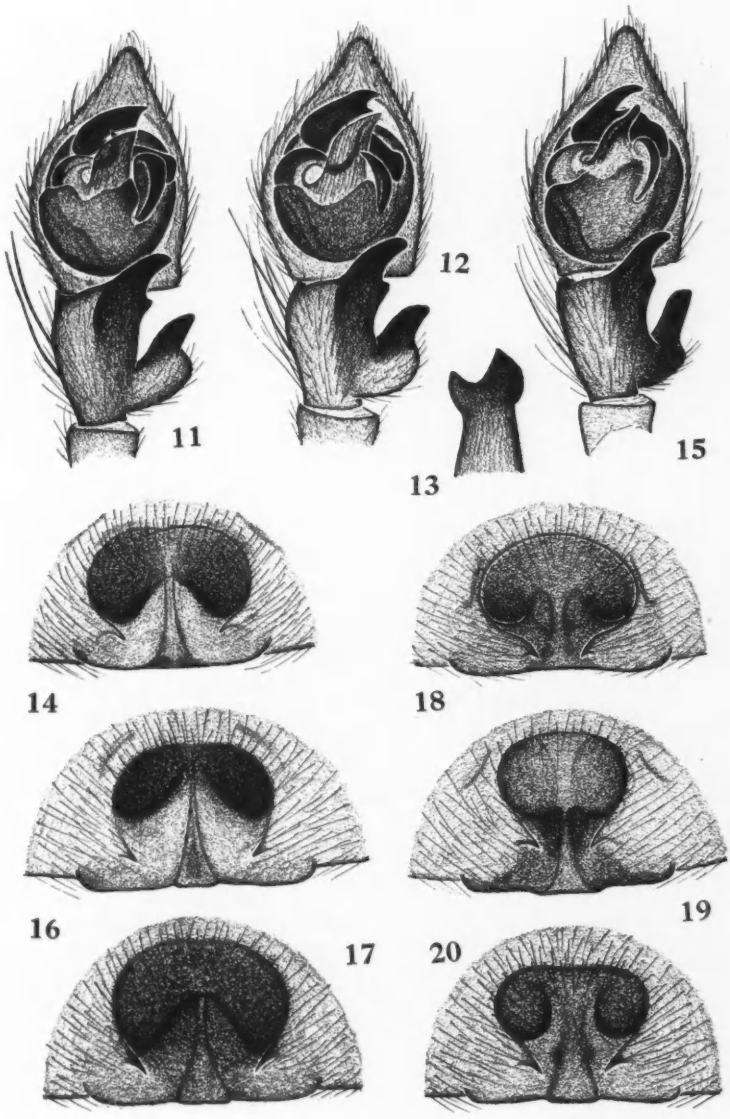
Known Localities:

122.37 3♀—(Type locality.)

" " ♂s ♀s—Many localities. (U. U., A. M.)

EXPLANATION OF PLATE II

Hololena oquirrhensis (Chamberlin and Gertsch). 11. Left palpus, ventral view. *Hololena nevada* (Chamberlin and Gertsch). 12. Left palpus, ventral view. 13. Tip of conductor of left palpus, posterio-ectal view. 14. Epigynum. *Hololena furcata* (Chamberlin and Gertsch). 15. Left palpus, ventral view. 16. Epigynum. *Hololena frianta* Chamberlin and Ivie, n. sp. 17. Epigynum. *Hololena pacifica* (Banks). 18. Epigynum. *Hololena curta* (McCook). 19. Epigynum. *Hololena tentativa* (Chamberlin and Gertsch). 20. Epigynum.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Hololena curta (McCook)

(Figs. 19, 23)

Agelena curta McCook, 1893, American Spiders, Vol. 3, Pl. 29, ff. 2-3.
Agelena curta Petrunkevitch, 1911, Catalogue, p. 527.
Agelena (Hololena) curta Chamberlin and Gertsch, 1929, Journ. Ent. and Zool., 21: 106.
Hololena tentativa Chamberlin and Ivie, 1941, Bull. Univ. Utah, 31(8):9 [Biol. ser. 6(3):9].

Color and structure typical; size above average.

Measurements:	♂	♀
Length	10.50 mm.	12.40 mm.
Carapace:		
Length	5.40	5.30
Width	3.50	3.50
Tibia-patella:		
I	5.20	4.85
IV	5.60	5.30

Type locality: "California."

Known Localities:

118.34 ♂'s ♀s—Los Angeles, Santa Monica, etc., California. (U. U., F. M., A. M.)
119.34 ♀—Santa Barbara, California; August 8, 1934; J. R. Douglas. (U. U.)

We are not certain that this species is the same as McCook's specimens, but it is one of the more probable species. Anyway, it may be so regarded, pending the resurrection of McCook's type specimens. Should his specimens not be found, we propose that this species be recognized as *curta*, and that a male and female from Los Angeles and Santa Monica respectively, tentatively labeled as neotypes and placed in the University of Utah collection, become the types.

Hololena tentativa (Chamberlin and Gertsch)

(Figs. 20, 27)

Agelena pacifica, var., Chamberlin, 1920, Journ. Ent. and Zool., Vol. 12, Pl. 3, fig. 6.
Agelena (Hololena) tentativa Chamberlin and Gertsch, 1929, Ibid., 21: 6, Pl. 3, ff. 31-32.
Agelena (Hololena) curta, id., Ibid., Pl. 3, f. 33.

Closely resemble *curta* in color and structure. The depression of the epigynum is wider anteriorly than in *curta*. The male palpus has the tongue-like process on the basal lobe of the tibia narrower than in *curta*, and the tip of the apical process of the conductor less truncate.

Measurements:	♂	♀ (large)
Length	10.00 mm.	13.50 mm.
Carapace:		
Length	5.50	6.70
Width	3.50	4.40
Tibia-patella:		
I	5.20	5.40
IV	5.80	5.90

Type locality: W 117° 45′ : N 34° 4′, Claremont, California; ♂ holotype, ♀ allotype; R. V. Chamberlin collector. (U. U.)

Known Localities:

117.34 ♂, ♀s—(Type locality.)
118.34 ♂—Los Angeles, California. (A. M.)
" " ♀—Los Angeles, California. (U. U.)

Hololena barbarana Chamberlin and Ivie, new species
(Fig. 37)

Color and structure typical. Close to *curta*, but differs in that the depression of the epigynum is smaller and farther removed from the genital furrow; the spurs are prominent.

Measurements:	♀ Holotype
Length	11.70 mm.
Carapace:	
Length	5.40
Width	3.60
Tibia-patella:	
I	4.80
IV	5.20

Type locality: W 119° : N 34°, Santa Cruz Island, California; ♀ holotype; March-April 1913; R. V. Chamberlin collector. (U. U.)

Known Localities:

118.34 3♀—Fillmore, California; November 6, 1927; O. F. Young. (U. U., A. M.)
119.34 ♀ (Type locality.)

Hololena santana Chamberlin and Ivie, new species
(Figs. 24–26)

Color and structure typical. Close to *tentativa*, with minor differences in the epigynum and palpus. The epigynum is distinctive, but the palpus is very close to *tentativa*, differing slightly in the shape of the tongue-like process on the basal lobe of the tibia.

Measurements:	♂ Allotype	♀ Holotype
Length	11.00 mm.	11.00 mm.
Carapace:		
Length	5.70	5.60
Width	3.80	3.80
Tibia-patella:		
I	5.30	5.30
IV	5.90	5.80

Type locality: W 117° 37′ : N 33° 41′, Irvine, California; ♀ holotype ♂ allotype, July 17, 1931; Wilton Ivie collector (U. U.) ♀ paratype, Monrovia Canyon, California; July 26, 1931; R. V. Chamberlin collector (U. U.)

Hololena dana Chamberlin and Ivie, new species
(Figs. 28–29)

Color and structure typical. Close to *curta*, *tentativa*, and *santana* but distinguishable by minor differences in the palpus and epigynum.

In the palpus, the median apophysis is slender and more pointed distally than in the other three species.

Measurements:	♂	♀
Length	8.70 mm.	11.20 mm.
Carapace:		
Length	4.40	6.00
Width	3.20	3.70
Tibia-patella:		
I	4.50	5.20
IV	5.20	5.60

Type locality: W 117° 50′ : N 33° 33′, Laguna Beach, California; ♂ holotype, ♀ allotype, ♀s paratypes; July 29, 1931; Wilton Ivie. ♀s ♂ paratypes; December 28, 1932; W. Ivie. (U. U.)

Known Localities:

117.33 2♂ ♀s—(Type locality).
117.32 ♀—Mouth of San Diego River, California; July 11, 1931; Wilton Ivie. (U. U.)

Hololena septata Chamberlin and Ivie, new species

(Fig. 36)

Color essentially typical; the annuli on the legs wide, and the median dorsal band of the abdomen shaded with dusky. The epigynum resembles that of *dana*, except that there is a distinct median septum.

Measurements:	♀ Holotype
Length	7.20 mm.
Carapace:	
Length	3.50
Width	2.50
Tibia-patella:	
I	3.30
IV	3.60

Type locality: W 116° 32′ : N 32° 50′, East of Pine Valley, California; ♀ holotype; collected in immature state September 13, 1941, matured October 6, 1941; Wilton Ivie collector. (U. U.)

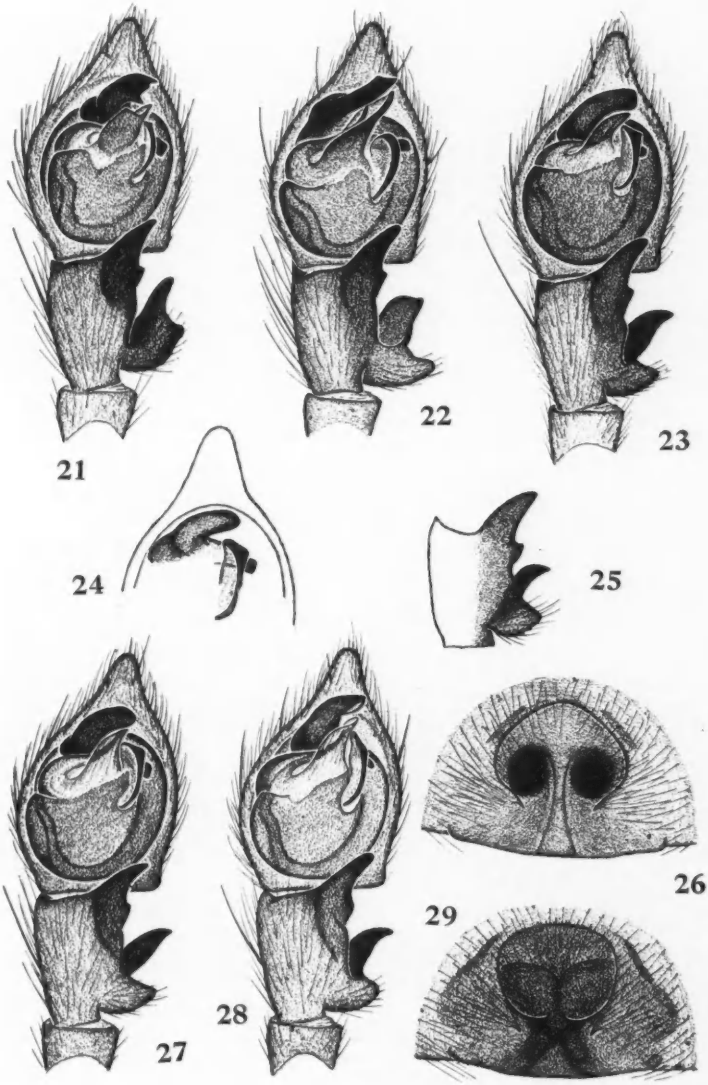
Hololena monterea Chamberlin and Ivie, new species

(Figs. 32–33)

Color and structure typical. The palpus and epigynum distinctive. The epigynum has a broad opening, with the spurs situated close to the posterior margin.

EXPLANATION OF PLATE III

Hololena frianta Chamberlin and Ivie, n. sp. 21. Left palpus, ventral view. *Hololena pacifica* (Banks). 22. Left palpus, ventral view. *Hololena curta* (McCook). 23. Left palpus, ventral view. *Hololena santana* Chamberlin and Ivie, n. sp. 24. Tip of left palpus, ventral view. 25. Tibia of left palpus, ventral view. 26. Epigynum. *Hololena tentativa* (Chamberlin and Gertsch). 27. Left palpus, ventral view. *Hololena dana* Chamberlin and Ivie, n. sp. 28. Left palpus, ventral view. 29. Epigynum.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Measurements:	♂ Holotype	♀ Allotype
Length	8.50 mm.	10.70 mm.
Carapace:		
Length	4.40	5.40
Width	3.00	3.30
Tibia-patella:		
I	4.40	4.45
IV	4.70	4.80

Type locality: W 121° 55′ : N 36° 38′, Pacific Grove, California; ♂ holotype, August 18, 1931; ♀ allotype, September 1, 1937; Wilton Ivie collector. (U. U.) 3 ♀ paratypes from near Monterey, California. (A. M.)

Hololena aduma Chamberlin and Ivie, new species

(Fig. 38)

Color and structure typical. Distinguishable in the female by the form of the epigynum. The depression is deep, with a sharp ridge across front extending around sides to the posterior point, formed by the spurs, which are more obtuse than usual and situated near the genital furrow.

Measurements:	♀ Holotype
Length	8.00 mm.
Carapace:	
Length	3.90
Width	2.70
Tibia-patella:	
I	3.40
IV	3.85

Type locality: W 121° 53′ : N 36° 35′, Monterey, California; ♀ holotype, ♀ paratype; March, 1936; Afton Williams collector. (U. U.)

Hololena pearcei Chamberlin and Ivie, new species

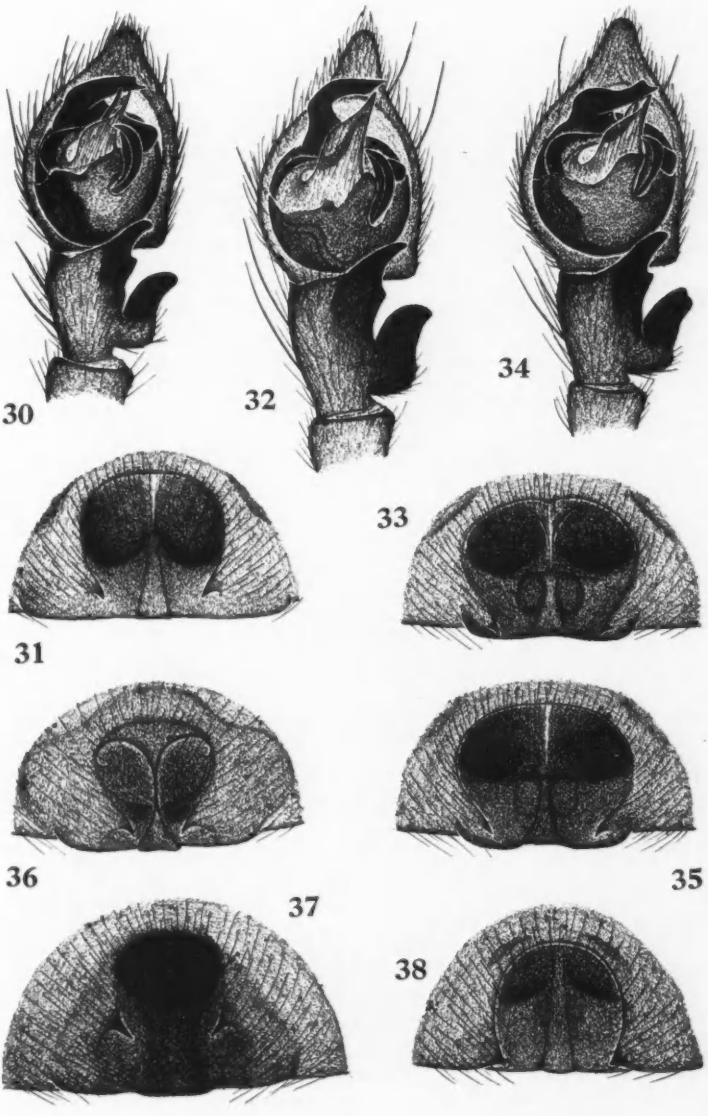
(Figs. 30-31)

Color typical, although sometimes paler than usual, especially in the male. The male palpus is distinct, although close to that of *sula*; the differences are shown in the figures. The epigynum bears resemblance to those of *furcata* and *sula*, both of which occur in the same region. The posterior margin does not extend as far into the depression as in *furcata*; the depression is slightly narrower than in *sula*.

Measurements:	♂	♀
Length	10.60 mm.	11.30 mm.
Carapace:		
Length	5.40	5.90
Width	3.50	3.70
Tibia-patella:		
I	5.30	4.60
IV	5.75	5.10

EXPLANATION OF PLATE IV

Hololena percei Chamberlin and Ivie, n. sp. 30. Left palpus, ventral view. 31. Epigynum. *Hololena monterea* Chamberlin and Ivie, n. sp. 32. Left palpus, ventral view. 33. Epigynum. *Hololena sula* Chamberlin and Ivie, n. sp. 34. Left palpus, ventral view. 35. Epigynum. *Hololena septata* Chamberlin and Ivie, n. sp. 36. Epigynum. *Hololena barbarana* Chamberlin and Ivie, n. sp. 37. Epigynum. *Hololena aduma* Chamberlin and Ivie, n. sp. 38. Epigynum.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Type locality: W 122° : N 37°, Castro Valley, California; ♂ holotype, ♀ allotype, 2 ♂ paratypes; October 23, 1938; W. M. Pearce collector. (A. M.)

Hololena sula Chamberlin and Ivie, new species

(Figs. 34–35)

Color and structure typical. Close to *pearcei*, except for minor differences in the palpus and epigynum, which are shown in the figures.

Measurements:	♂	♀
Length	8.30 mm.	9.50 mm.
Carapace:		
Length	4.20	4.30
Width	2.90	2.70
Tibia-patella:		
I	4.40	3.90
IV	4.90	4.20

Type locality: W 121° 50′ : N 37° 30′, Sunol, California; ♂ holotype, ♀ allotype; December 16, 1938; T. Aitkin collector. (A. M.)

Hololena tulareana Chamberlin and Ivie, new species

(Fig. 43)

Color and structure essentially typical. The male palpus distinctive.

Measurements:	♂ Holotype
Length	7.40 mm.
Carapace:	
Length	4.00
Width	2.60
Tibia-patella:	
I	3.90
IV	....

Type locality: W 118° : N 36°, Tulare County, California; ♂ holotype. (U. U.)

Hololena oola Chamberlin and Ivie, new species

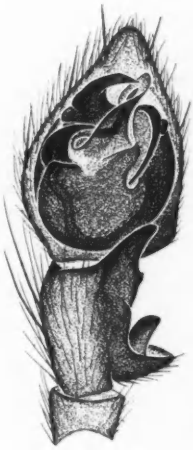
(Fig. 46)

Color and structure typical. The two openings of the epigynum are separated by a prominent septum.

Measurements:	♀ Holotype
Length	9.70 mm.
Carapace.	
Length	4.40
Width	2.95
Tibia-patella:	
I	4.00
IV	4.50

EXPLANATION OF PLATE V

Hololena nedra Chamberlin and Ivie, n. sp. 39. Left palpus, ventral view. 40. Epigynum. *Hololena sidella* Chamberlin and Ivie, n. sp. 41. Left palpus, ventral view. *Hololena turba* Chamberlin and Ivie, n. sp. 42. Epigynum. *Hololena tulareana* Chamberlin and Ivie, n. sp. 43. Left palpus, ventral view. *Hololena adnexa* (Chamberlin and Gertsch). 44. Left palpus, ventral view. 45. Epigynum. *Hololena oola* Chamberlin and Ivie, n. sp. 46. Epigynum.



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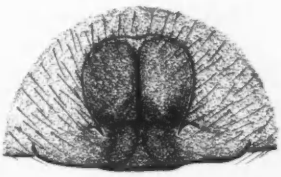

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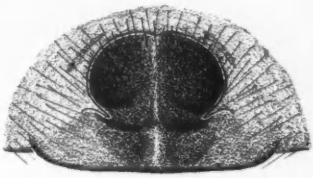

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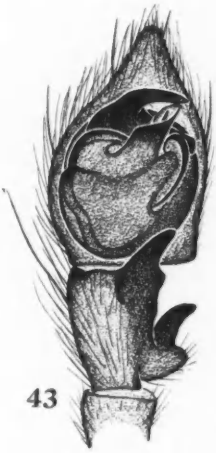

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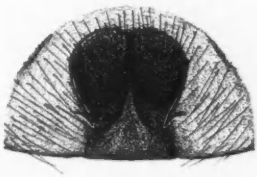

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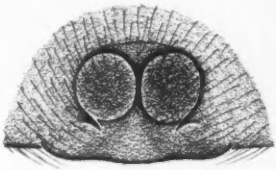

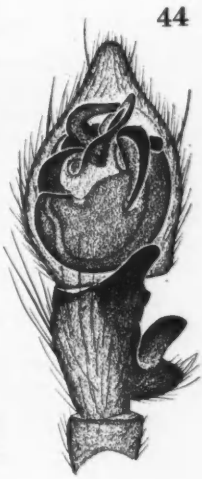

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Type locality: W 119° 44′ : N 36° 46′, 4 mi. East of Fresno, California; ♀ holotype; December 26, 1922; C. D. Duncan collector. (U. U.)

Hololena adnexa (Chamberlin and Gertsch)

(Figs. 44–45)

Agelena (*Hololena*) *adnexa* Chamberlin and Gertsch, 1929, Journ. Ent. and Zool., 20: 108, Pl. 3, ff. 34–36.

Color and structure essentially typical; males often pale in color, with little or no markings apparent on the legs. The epigynum has a median ridge; it is not easily distinguishable from that of ***nedra***. The male palpus is distinguishable by the long, flat, tongue-like process on the basal lobe of the tibia, and the slight notch in the end of the distal process of the conductor.

Measurements:	♂ Holotype	♀
Length	8.50 mm.	11.00 mm.
Carapace:		
Length	4.40	5.40
Width	3.00	3.40
Tibia-patella:		
I	4.45	4.70
IV	4.95	5.30

Type locality: W 122° 20′ : N 37° 34′, Stanford, California; ♂ holotype; J. C. Chamberlin collector. (U. U.)

Known Localities:

121.38 4♀—Solano Co., California; W. M. Pearce. (A. M.)
121.37 4♀—Clayton, California; W. M. Pearce. (A. M.)
122.37 ♂—(Type locality.)
" " ♀—Berkeley, California; April, 1931; A. M. Woodbury; allotype. (U. U.)
" " 2♂ ♀—San Francisco, California; September, 1931; Sternitzky. (A. M.)

Hololena turba Chamberlin and Ivie, new species

(Fig. 42)

Close to *adnexa* in size, color, and structure, but with a different form of epigynum. The spurs of the epigynum are anterior to the posterior rim of the depression, and are very slender.

Type locality: W 122° : N 39°, Clear Lake, California; ♀ holotype, ♀ paratype; September 9, 1938; J. C. Chamberlin collector. (U. U.)

Known Localities:

122.39 2♀—(Type locality.)
122.38 ♀—Marin County, California. (U. U.)

Hololena sidella Chamberlin and Ivie, new species

(Fig. 41)

This species is close to *adnexa*, but differs principally in the distal process on the conductor of the palpus.

Measurements:	♂ Holotype
Length	9.50 mm.
Carapace:	
Length	5.00
Width	3.30
Tibia-patella:	
I	4.80
IV	5.50

Type locality: W 119° : N. 37°, Aspen Valley, Yosemite Park, California; ♂ holotype; August 11, 1931; Wilton Ivie collector. (U. U.)

Hololena nedra Chamberlin and Ivie, new species
(Figs. 39–40)

Agelena (Hololena) curta, Exline, 1938, Univ. Wash. Publ. Biol., 9:27.

Color and structure typical. The epigynum is not readily distinguishable from that of *adnexa*. The palpus is near that of *adnexa* and *sidella*, but the tip of the distral process of the conductor is more slender and lacks a notch as in *adnexa*.

Measurements:	♂ (large)	♀ (large)	♀ (small)
Length	11.10 mm.	13.00 mm.	7.60 mm.
Carapace:			
Length	5.90	6.30	4.00
Width	3.85	4.15	2.70
Tibia-patella:			
I	5.50	5.10	3.40
IV	6.15	5.50	3.95

Type locality: W 123° 16′ : N 44° 34′, Corvallis, Oregon; ♂ holotype, ♀ allotype; September 26, 1933; J. Schuh collector. Also a male and several females collected at various dates. (A. M.)

Known Localities:

119.36 ♂ 2♀—Fresno, California; December 26, 1922; C. D. Duncan. (U. U.)
121.37 ♂—Brentwood, California; September 13, 1938; W. M. Pearce. (A. M.)
122.47 —Washington: Olympia, San Juan Is., Seattle (Exline). (M.C.Z.)
122.45 ♂ ♀—Portland, Oregon; July 25, 1935; J. M. Pierson. (A. M.)
" " 7♀—Portland, Oregon; May, 1935; J. Schuh. (A. M., U. U.)
122.38 ♀—Somona County, California; June. (A. M.)
123.45 2♂ ♀—McMinnville, Oregon; 1935; Fender. (A. M.)
" " ♀—Forest Grove, Oregon; August 6, 1929; R. V. Chamberlin. (U. U.)
123.44 2♂ 7♀—(Type locality.)
123.43 ♂—Yoncalla, Oregon; 1939; Betty McGinitie. (U. U.)

Hololena rabana Chamberlin and Ivie, new species
(Fig. 49)

This species is close to *nedra*, from which it may be readily separated by the difference in the tongue-like process on the basal lobe of the tibia of the palpus. The tip of the distal process of the conductor is sharply pointed.

Measurements:	♂ Holotype
Length	7.00 mm.
Carapace:	
Length	3.55
Width	2.60
Tibia-patella:	
I	4.20
IV	4.75

Type locality: W 122° 21′ : N 42° 6′, Pinehurst, Oregon; ♂ holotype; Sept. 9, 1935; Chamberlin and Ivie collectors. (U. U.)

Hololena parana Chamberlin and Ivie, new species
(Figs. 47–48)

Color typical. Structure similar to that of *nedra* and related species, except for minor differences in the palpus and epigynum. The epigynum resembles that of *turba*, except that the median ridge is more prominent.

Measurements:	♂ Holotype	♀ Allotype
Length	10.10 mm.	9.00 mm.
Carapace:		
Length	5.30	4.50
Width	3.40	2.95
Tibia-patella:		
I	5.00	4.10
IV	5.50	4.70

Type locality: W 119° 52′ : N 39° 32′, Reno, Nevada; ♂ holotype, ♀ allotype; January, 1940; from University of Nevada collection. (U.U.)

Hololena lassena Chamberlin and Ivie, new species
(Figs. 50–51)

Color typical, with a tendency toward more shading with gray than usual. The epigynum has a relatively small depression. The palpus has the tongue-like process on the basal lobe of the tibia very short, and the apical process of the conductor is slender and sharply pointed.

Measurements:	♂	♀ Holotype
Length	7.00 mm.	8.50 mm.
Carapace:		
Length	3.50	3.85
Width	2.47	2.40
Tibia-patella:		
I	4.10	3.65
IV	4.65	4.25

Type locality: About W 121° 30′ : N 40° 30′, Mount Lassen Park California; ♀ holotype; July 1, 1940; W. M. Pearce collector. (A. M.)

Known Localities:

120.39 ♀—Peavine, California; June 8, 1940; W. M. Pearce. (A. M.)
120.40 ♀—Loyalton, California; June 17, 1940; W. M. Pearce. (A. M.)
121.40 ♀—(Type locality.)
" " ♀—Chester, California; June 28, 1940; W. M. Pearce. (A. M.)
" " 2♂ ♀—Hat Creek, California; September 7, 1935; Chamberlin and Ivie. (U. U.)

Hololena altura Chamberlin and Ivie, new species
(Figs. 52–53)

Color and structure typical. The epigynum resembles that of *lassena*, but the depression is larger. The palpus is close to that of

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EXPLANATION OF PLATE VI

Hololena parana Chamberlin and Ivie, n. sp. 47. Left palpus, ventral view. 48. Epigynum. *Hololena rabana* Chamberlin and Ivie, n. sp. 49. Left palpus, ventral view. *Hololena lassena* Chamberlin and Ivie, n. sp. 50. Left palpus, ventral view. 51. Epigynum. *Hololena altura* Chamberlin and Ivie, n. sp. 52. Left palpus, ventral view. 53. Epigynum.

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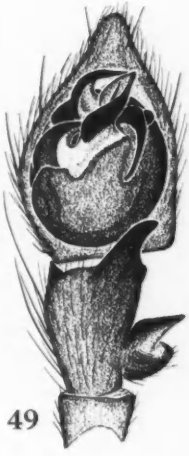

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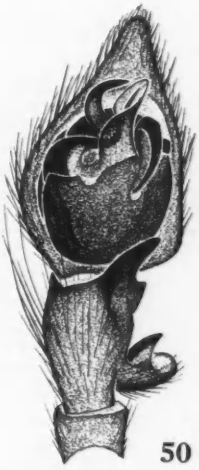

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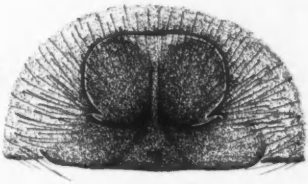

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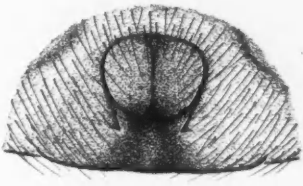

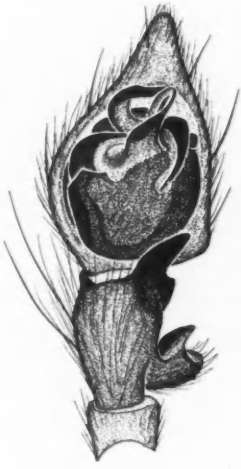

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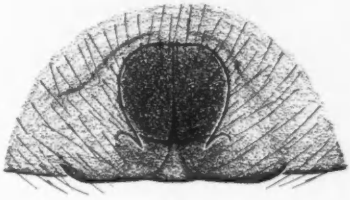


lassena, but the tip of the distal process of the conductor is of a different shape.

Measurements:	♂ Holotype	♀ Allotype
Length	8.00 mm.	9.00 mm.
Carapace:		
Length	4.00	4.50
Width	2.75	2.90
Tibia-patella:		
I	4.40	4.10
IV	5.00	4.65

Type locality: W 122° 25′ : N 41° 25′, Weed, California; ♂ holotype, ♀ allotype ♂'s and ♀s paratypes; September 8, 1935. Chamberlin and Ivie collectors. (U. U., A. M.)

Genus **Novalena** Chamberlin and Ivie, new

Agelena (in part), various authors.
Agelenopsis (in part), F. Cambridge, 1902, Biologia Centrali-Americana, 2: 336–338.
Agelena (subgenus *Hololena*) (in part), Exline, 1938, Univ. Wash. Publ. Biol., 9: 28.
Novalena Chamberlin and Ivie, 1941, Bull. Univ. Utah, 31(8):9 [Biol. ser. 6(3):9].

Typical color: Carapace with the usual color pattern (i. e., as in *Hololena*), except that the brown bands are usually more diffused or broken, and the whole carapace is more shaded. Chelicerae reddish brown, more or less shaded with dusky. Sternum yellowish brown, shaded with dusky; more shaded on lateral margins, less along mid-line. Labium and endites brownish orange, with whitish tips; the labium slightly shaded with dusky. Legs yellowish brown, shaded with dusky; the femur with a conspicuous pale annulus at base; faint annuli sometimes discernible on tibia. Abdomen dark gray, with a typical pattern above, much as in *Hololena*, but shaded with gray; venter dark gray, with a whitish line along each side. Spinnerets orange brown.

Typical structure: In general close to *Hololena*. Anterior eyes larger than the posterior eyes; the four eyes of each row, usually about equal. Chelicerae with two or three teeth on posterior margin of fang groove. Hind spinnerets with the apical segment about the same length as the basal segment. Spines on legs essentially as in the typical Ageleneae.

Epigynum ordinarily much reduced, with considerable variation in details of structure among the different species.

Palpus: Femur and patella unmodified. Tibia short, and variously sculptured on the ectal side. The cymbium is simple, with the distal prolongation short. The tegulum is simple and extends directly into the embolus, which is short and simple. The median apophysis is not significantly different from that of *Hololena* or *Calilena*, but shows considerable variation between species. The fulcrum is poorly or not at all developed, as in *Calilena*, and as in distinct contrast to *Hololena*. The conductor has a short distal process, which contains the tip of the embolus, and a short flat tail-piece dorsal or ectal to the distal process.

Genotype: *Novalena intermedia* (Chamberlin and Gertsch) (from Agelena).

This genus consists of a number of quite different forms, so far as the structure of the palpus and epigynum is concerned.

It seems to be one of the more common forms in Mexico and Central America, and extends northward in the western United States to Canada. This genus shows close relationship to the genera *Calilena*, *Hololena*, and *Rualena*. From *Hololena*, it is distinguishable by its darker color, longer hind spinnerets, the reduced epigynum in the female, and in the male by the fact that the tip of the embolus is held by the distal process of the conductor and not by a well-developed fulcrum. From *Calilena*, it can be distinguished by the shorter hind spinnerets, and in the female by the absence of the median stylus on the epigynum. From *Rualena*, it differs in its larger size, darker color and less delicately constructed palpus and epigynum. (We were somewhat hesitant about separating *Novalena* and *Rualena*, but finally did so on the basis of the differences mentioned above. We must admit, however, that intuition played a considerable part in this decision.)

Novalena intermedia (Chamberlin and Gertsch)

(Figs. 54–55)

Agelena intermedia Chamberlin and Gertsch, 1930, Proc. Biol. Soc. Wash., 43: 143, fig. 28.
Agelena (Hololena) intermedia Exline, 1938, Univ. Wash. Publ. Biol., 9: 28.
Novalena intermedia Chamberlin and Ivie, 1941, Bull. Univ. Utah, 31(8):9 [Biol. ser. 6(3):9].

Color typical. Structure essentially typical. Hind margin of the fang groove of the chelicerae with a small third tooth between the usual two, in the female, but not in the male. The structure of the palpus and epigynum is shown in the figures.

Measurements:	♂ Holotype	♀ Allotype
Length	9.00 mm.	9.00 mm.
Carapace:		
Length	4.60	4.40
Width	3.00	3.00
Tibia-patella:		
I	4.65	4.25
IV	5.40	4.70

Type locality: W 122° 17′ : N 37° 20′, La Honda, California; ♂ holotype, ♀ allotype; November 4, 1922; J. C. Chamberlin collector. (U. U.)

Known Localities:

120.39 ♂—Nevada County, California. (A. M.)
121.40 ♂—Mt. Lassen Park, California; June 28, 1940; W. M. Pearce. (A. M.)
122.47 ♀—Seattle, Washington. (A. M.)
122.42 —Crater Lake, Oregon. (Exline).
" " 2♂ 4♀—Base of Mt. McLaughlin, Oregon; June 22, 1934; Lawrence. (A. M., U. U.)
" " ♀—Lake of Woods, Oregon; July 1–4, 1934; Lawrence. (A. M.)
122.37 ♂ ♀—(Type locality.)
123.47 —No. Fork Skokomish River, Washington. (Exline).

Novalena pina Chamberlin and Ivie, new species

(Fig. 56)

Novalena intermedia, Chamberlin and Ivie, Bull. Univ. Utah, 31(8):9 [Biol. ser. 6(3):9].

Color similar to that of ***intermedia***. The structure is also similar, except for a slight difference in the epigynum, as shown in the figures.

Measurements:	♀ Holotype
Length	10.50 mm.
Carapace:	
Length	4.30
Width	3.00
Tibia-patella:	
I	3.80
IV	4.40

Type locality: W 120° 52′ : N 38° 8′, Echo Lake, California; ♀ holotype, ♀ paratype; July 1934; L. W. Saylor. (U. U.)

Novalena approximata (Gertsch and Ivie)

(Fig. 63)

Agelena approximata Gertsch and Ivie, 1936, Amer. Mus. Novitates, No. 858: 23, ff. 45, 51, 52.

Color and structure essentially typical.

Measurements:	♂ Holotype	♀ Allotype
Length	7.10 mm.	10.50 mm.
Carapace:		
Length	3.80	5.00
Width	2.40	3.20
Tibia-patella:		
I	3.40	3.80
IV	3.90	4.40

Type locality: W 84° 5′ : N 9° 59′, San Jose, Costa Rica; ♂ holotype, ♀ allotype. (A. M.)

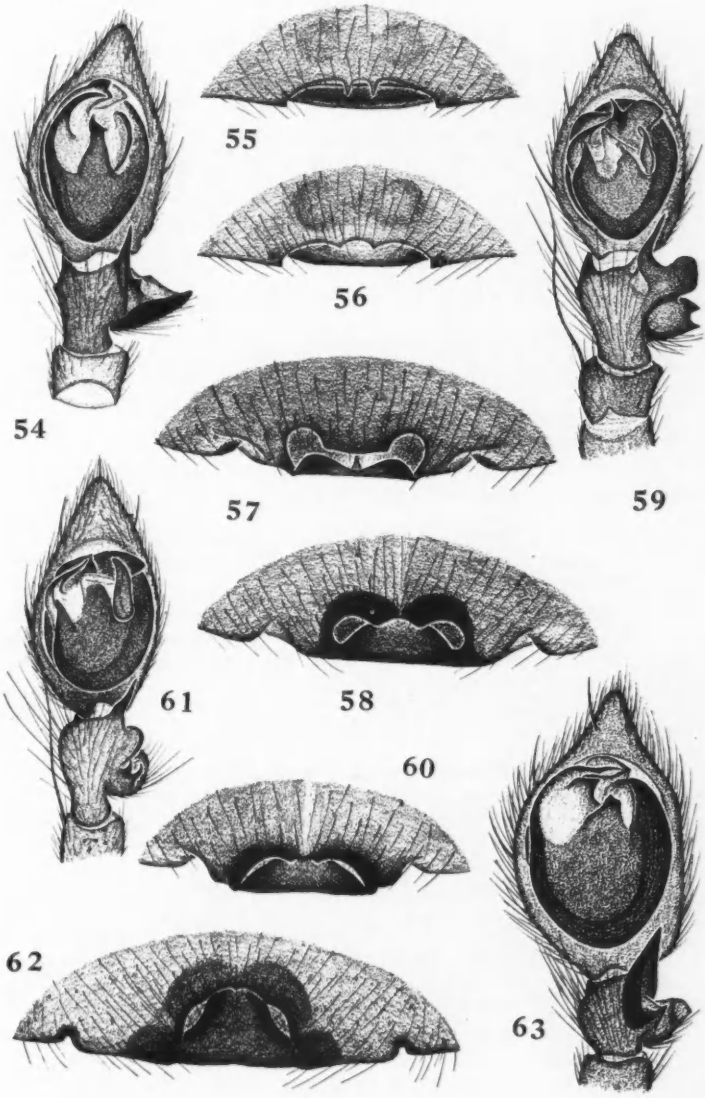
Novalena tolucana (Gertsch and Davis)

Agelena tolucana Gertsch and Davis, 1940, Amer. Mus. Novitates, No. 1059: 3, ff. 4, 6.

Color and general structure typical. A. M. eyes smaller than the A. S. eyes. The palpus is very similar to that of ***approximata***; the epigynum is much different.

EXPLANATION OF PLATE VII

Novalena intermedia (Chamberlin and Gertsch). 54. Left palpus, ventral view. 55. Epigynum. *Novalena pina* Chamberlin and Ivie, n. sp. 56. Epigynum. *Novalena idahoana* (Gertsch). 57. Epigynum. *Novalena wawona* Chamberlin and Ivie, n. sp. 58. Epigynum. *Novalena lutzi* (Gertsch). 59. Left palpus, ventral view. 60. Epigynum. *Novalena calavera* Chamberlin and Ivie, n. sp. 61. Left palpus, ventral view. 62. Epigynum. *Novalena approximata* (Gertsch and Ivie). 63. Left palpus, ventral view.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Measurements:	♂	♀
Length	9.10 mm.	9.60 mm.
Carapace:		
Length	4.70	4.50
Width	3.00	3.00
Tibia-patella:		
I	3.10	3.75
IV	4.60	4.35

Type locality: W 99° 42′ : N 19° 10′, Mt. Toluca, Mexico; ♀ holotype, ♂ allotype, ♀ paratype; June 28, 1936; A. M. and L. I. Davis. (A. M.)

Known Localities:

98.19 ♀—Mt. pass east of Mexico City, Mexico; June 20, 1936; A. M. and L. I. Davis. (A. M.)
99.19 ♂ 2♀—(Type locality.)
" " ♂—Mexico City, Mexico; April, 1941; H. Wagner. (A. M.)

Novalena attenuata (F. Cambridge)

Agelenopsis attenuata F. Cambridge, 1902, Biol. Centr. Amer., 2: 337, Pl. 32, f. 7.
Agelena attenuata Petrunkevitch, 1911, Catalogue, p. 527.

Length of female 7.5 mm. No other description given. The figure of the epigynum is evidently of the *Novalena* type.

Type locality: Omilteme, Guerrero, Mexico; ♀ holotype; H. H. Smith collector. (Godman and Salvin collection).

Novalena costata (F. Cambridge)

Agelenopsis costata F. Cambridge, 1902, Biol. Centr. Amer., 2: 337, Pl. 32, f. 6.
Agelena costata Petrunkevitch, 1911, Catalogue, p. 527.

Total length of female 13 mm. Carapace brown with an indistinct, broad, central and marginal band. Abdomen brown, with a broad, central, dentated, dull red band. Legs dark red-brown, femora distinctly annulated with black. (F. Cambridge.)

Type locality: About W 84° : N 10°, Costa Rica; ♀ holotype; Rodgers collector. (Godman and Salvin collection.)

Novalena nova (Cambridge)

Agelena nova Cambridge, 1896, Biol. Centr. Amer., 1: 175, Pl. 22, f. 5.
Agelenopsis nova F. Cambridge, 1902, Ibid., 2: 336, Pl. 31, f. 35.
Agelena nova Petrunkevitch, 1911, Catalogue, p. 528.

Total length 6 mm.

Type locality: Vera Paz, Guatemala; ♂ holotype; Sarg collector. (Godman and Salvin collection.)

Novalena marginata (F. Cambridge)

Agelenopsis marginata F. Cambridge, 1902, Biol. Centr. Amer., 2: 336, Pl. 31, f. 36.
Agelena marginata Petrunkevitch, 1911, Catalogue, p. 528.

Total length of female 9 mm. Carapace brown, with a broad central and marginal white longitudinal band. Abdomen brown, with a broad, pale, central, longitudinal band, the anterior third brown, the posterior portion dull red. Legs yellow brown, femora distinctly annulate. (F. Cambridge.)

Type locality: Omilteme, Guerrero, Mexico; ♂ holotype; H. H. Smith collector. (Godman and Salvin collection.)

Novalena annamae (Gertsch and Davis)

Agelena annamae Gertsch and Davis, 1940, Amer. Mus. Novitates, No. 1059: 2, ff. 3, 7, 8.

Color essentially typical. A. M. eyes smaller than the A. S. eyes. Hind margin of fang groove with three small teeth. Anterior margin of the epigynum with two cusps.

Measurements:	♂	♀
Length	7.50 mm.	9.50 mm.
Carapace:		
Length	3.80	4.45
Width	2.40	2.80
Tibia-patella:		
I	4.05	4.30
IV	4.72	4.95

Type locality: W 100° 28′ : N 19° 21′, Zitacuaro, Michoacan, Mexico; ♀ holotype, ♂ allotype; June 27, 1936; L. I. Davis. (A. M.)

Novalena idahoana (Gertsch)

(Fig. 57)

Color and structure typical. Anterior eyes equal. Hind margin of fang groove on the chelicerae with two teeth. Epigynum as figured.

Measurements:	♀
Length	10.00 mm.
Carapace:	
Length	4.80
Width	3.20
Tibia-patella:	
I	4.60
IV	5.30

Type locality: W 111° 18′ : N 42° 18′, Montpelier, Idaho; ♀ holotype; August, 1931; W. J. Gertsch collector. (A. M.)

Known Localities:

110.39 ♀—Price, Utah; September, 1940; Harold Higgins. (U. U.)
111.42 ♀—(Type locality.)
111.40 ♀s—Wasatch Mts., Utah; various localities and dates. (U. U.)

Novalena lutzi (Gertsch)

(Figs. 59–60)

Agelena lutzi Gertsch, 1933, Amer. Mus. Novitates, No. 637: 12, f. 9.

Close to *idahoana*. Color and structure in general typical. The light parts of the cephalothorax are conspicuously clothed with pale gray hairs.

Measurements:	♂	♀
Length	7.70 mm.	10.50 mm.
Carapace:		
Length	3.90	5.20
Width	2.95	3.50
Tibia-patella:		
I	4.85	4.80
IV	5.60	5.60

Type locality: W 108° : N 37°, Mesa Verde Park, Colorado; ♂ holotype; July, 3–7, 1919; F. E. Lutz collector. (A. M.)

Known Localities:

105.39 ♀—15 mi. West of Denver, Colorado; August 24, 1935; W. Ivie. (U. U.)
107.32 ♀—Nimbres Mts., New Mexico; September 7, 1941; Wilton Ivie. (U. U.)
108.37 ♂—(Type locality.)
110.38 2♀—Horse Valley, Henry Mts., Utah; April 7, 1929; W. J. Gertsch. (U. U.)
112.37 ♀—Cedar Canyon, Utah; June 10, 1927; R. V. Chamberlin. (U. U.)
112.36 4♂—Kaibab Forest, Arizona; June 14, 1934; Ivie and Rasmussen. (U. U.)

Novalena wawona Chamberlin and Ivie, new species

(Fig. 58)

This species is close to *idahoana* and *lutzi*. The color is similar. The front eyes are large and equal, as in those species. The chelicerae have only two teeth on the hind margin of the fang-groove.

Measurements:	♀ Holotype
Length	11.00 mm.
Carapace:	
Length	5.40
Width	3.70
Tibia-patella:	
I	5.20
IV	6.00

Type locality: W 119° : N 37°, Wawona Camp, Yosemite Park, California; ♀ holotype; September 17, 1941; Wilton Ivie collector. (U. U.)

Novalena calavera Chamberlin and Ivie, new species

(Figs. 61–62)

This large species is closely related to the three foregoing species. The palpus has a pair of sharp points on the basal part of the tibia, as in lutzi, but differently shaped. The eyes and armature of the chelicerae are similar.

Measurements:	♀♂ Holotype	♀
Length	9.35 mm.	11.40 mm.
Carapace:		
Length	4.85	5.90
Width	3.33	4.00
Tibia-patella:		
I	5.72	5.70
IV	6.50	6.50

Type locality: W 120° 21′ : N 38° 49′, Riverton, California; ♂ holotype, ♀ allotype; 3 ♀ paratypes; July 15, 1934; Ivie and Rasmussen collectors. (U. U., one ♀ A. M.)

Novalena orizaba (Banks)

Agelena orizaba Banks, 1898, Proc. Calif. Acad. Sci., 1: 231, Pl. 14, f. 30.
Agelenopsis orizaba F. Cambridge, 1902, Biol. Centr. Amer., 2: 338.
Agelena orizaba Petrunkevitch, 1911, Catalogue, p. 528.

The following is a copy of the original description:

"Length ♀ 9 mm. Cephalothorax and legs rather reddish yellow, faint traces of marks on the former; abdomen grayish, rather uniformly finely netted with brown and a pale stripe above, dentate behind and margined with blackish spots; spinnerets pale; venter brownish; sternum yellow-brown; mandibles red-brown. P. M. E. less than diameter apart, as far from the P. S. E. Last joint of the superior spinnerets shorter than the basal one. The epigynum has a transverse bridge somewhat like that of *A. naevia*, at end of which there is a black mark."

Type locality: W 97° : N 19°, Mt. Orizaba, Mexico; ♀ holotype. (Presumably destroyed in San Francisco earthquake and fire in 1906.)

We are not certain of the position of this species from the description and figure, but it appears most probable that it belongs in this genus.

Novalena lobata (F. Cambridge)

Agelenopsis lobata F. Cambridge, 1902, Biol. Centr. Amer., 2: 336, Pl. 32, f. 2.
Agelena lobata, Petrunkevitch, 1911, Catalogue, p. 528.

Female. Total length 8 mm. Carapace brown, with a broad central and marginal pale band. Sternum brown, with a narrow central, pale band. Abdomen deep brown, with an indistinct, pale, dull, red, central band. Legs yellow-brown, femora distinctly annulated with black, (F. Cambridge).

Type locality: Omilteme, Guerrero, Mexico; ♀ holotype; H. H. Smith collector. (Godman and Salvin collection).

Novalena cuspidata (F. Cambridge)

Agelenopsis cuspidata F. Cambridge, 1902, Biol. Centr. Amer., 2: 337, Pl. 32, f. 3.
Agelena cuspidata Petrunkevitch, 1911, Catalogue, p. 527.

Female. Total length 8 mm. Color same as in *N. lobata*. (F. Cambridge.)

Type locality: Omilteme, Guerrero, Mexico; H. H. Smith collector. (Godman and Salvin collection).

Novalena variabilis (F. Cambridge)

Agelenopsis variabilis F. Cambridge, 1902, Biol. Centr. Amer., 2: 338, Pl. 32, f. 9.
Agelena variabilis Petrunkevitch, 1911, Catalogue, p. 529.

Female. Total length 12 mm. Carapace brown, with a broad central and marginal band of white hairs. Abdomen with a broad, central, red band margined with yellow-white; ventral area pale dun-color. Legs deeply and almost entirely suffused with brown, the femora with a long pale slash on the outer side. The epigynum appears to be exceedingly variable. (F. Cambridge.)

Type locality: Omilteme, Guerrero, Mexico; Duges collector.

Other Localities:

99.17 ♀—Chilpancingo, Mexico.
♀—Xautipa, Mexico. (Godman and Salvin collection.)

Genus **Rualena** Chamberlin and Ivie, new

Color very similar to that of a typical *Hololena*. Carapace with a wide, median, light band, as wide or wider than the eye area in front, slightly narrowed on thoracic part; the usual pair of brownish bands, and a wide light band on margin of thorax. Chelicerae reddish brown. Labium and endites orange, with whitish tips; the labium lightly shaded with gray. Sternum yellowish, with a narrow light median line extending the full length; the rest shaded or mottled with gray. Legs light yellowish brown, with faint annuli sometimes present. Abdomen with a broad, pale, dentate band above, sometimes enclosing on the basal part a lanceolate mark of darker gray; upper sides, next to mid-band, dark gray, lighter below and more or less spotted. Venter pale gray or yellowish-gray, with a broken black line along each side, more or less specked with dark gray.

Structure: Anterior median eyes distinctly smaller than the lateral eyes; posterior eyes equal, equidistant, about three-fourths diameter apart. Chelicerae with two teeth on hind margin of fang groove. Spines of legs essentially the same as in *Hololena*. Hind spinnerets with the apical segment the same length or slightly shorter than the basal segment.

Epigynum: A small cavity, sometimes partially divided, with a lateral ridge, which usually ends posteriorly in one or two points; usually a ridge across the posterior end of the cavity.

Palpus very simple. The tibia usually has a distal process on the ectal side, which is developed into two points; or this process may be absent. The palpal organs are of the same general pattern as those of *Novalena*. The whole structure is more delicate than in *Novalena*.

Genotype: Rualena surana Chamberlin and Ivie, n. sp.

This genus is very close to *Novalena* (see remarks under *Novalena*). The whole general appearance, however, is different; it being lighter in color, usually smaller in size, with a distinct difference in the general appearance of the palpus and epigynum. The study of more species may possibly justify its being relegated to the rank of a sub-genus.

Rualena simplex (F. Cambridge)

Agelenopsis simplex F. Cambridge, 1902, Biol. Centr. Amer., 2: 336, Pl. 32, f. 1.
Agelena simplex Petrunkevitch, 1911, Catalogue, p. 528.

Male. Total length 9 mm. Carapace brown, with a central and marginal pale band. Abdomen deep brown, with an indistinct, dentated, pale, central band. Legs brown, femora distinctly annulated with darker brown. Palpus simple, without external processes on the tibia. (F. Cambridge.)

Type locality: Guatemala; ♂ holotype; Sarg collector. (Godman and Salvin collection.)

Rualena cavata (F. Cambridge)

Agelenopsis cavata F. Cambridge, 1902, Biol. Centr. Amer., 2: 337, Pl. 32, f. 5.
Agelena cavata Petrunkevitch, 1911, Catalogue, p. 527.

Female. Total length 7.5 mm. This species is evidently closely related to *cruzana*, which follows, and probably agrees with it rather closely in color and structure. The epigynum is of the same sort.

Type locality: Omilteme, Guerrero, Mexico; ♀ holotype; H. H. Smith collector. (Godman and Salvin collection.)

Rualena cruzana Chamberlin and Ivie, new species
(Figs. 65–66)

Color and structure typical, the significant differences being in the palpus and epigynum, which are illustrated.

Measurements:	♂ Holotype	♀
Length	5.30 mm.	9.50 mm.
Carapace:		
Length	2.80	4.70
Width	1.95	3.30
Tibia-patella:		
I	3.15	4.40
IV	3.70	5.15

Type locality: W 119° : N 34°, Santa Cruz Island, California; ♂ holotype, ♀ allotype, several ♀ paratypes; March, 1913; R. V. Chamberlin collector. (U. U., ♀ A. M.)

Rualena rua (Chamberlin)

Agelena rua Chamberlin, 1920, Journ. Ent. and Zool., 12: 9, Pl. 4, f. 1.

The color is essentially typical. In structure, it is closely related to *cruzana*.

Measurements:	♂
Length	7.00 mm.
Carapace:	
Length	3.20
Tibia-patella:	
I	4.50
IV	4.70

Type locality: W 118° 20′ : N 33° 21′, Avalon Bay, Santa Catalina Island, California; ♂ holotype; August 25, 1918; Wm. A. Hilton collector. (M. C. Z.)

Rualena cockerelli Chamberlin and Ivie, new species
(Fig. 67)

Color of the typical pattern, somewhat darker than usual, with fairly distinct annuli on the femora of the legs. The epigynum is figured.

Measurements:	♀ Holotype
Length	9.30 mm.
Carapace:	
Length	4.15
Width	2.67
Tibia-patella:	
I	3.80
IV	4.40

Type locality: About W 120° 25′ : N 34° 3′, San Miguel Island, California; ♀ holotype, ♀ paratype; summer 1938; T. D. A. Cockerell collector. (A. M.)

Rualena surana Chamberlin and Ivie, new species

(Fig. 68)

Rualena surana Chamberlin and Ivie, 1941, Bull. Univ. Utah, 31(8):9 [Biol. ser. 6(3):9].

Color and structure typical. Color light brownish yellow in general, as is typical for light colored specimens of *Hololena*.

Measurements:	♀ Holotype
Length	7.20 mm.
Carapace:	
Length	3.40
Width	2.30
Tibia-patella:	
I	3.00
IV	3.40

Type locality: W 121° 52′ : N 36° 16′, Big Sur, California; ♀ holotype, ♀ paratype; April 10, 1937; L. W. Saylor collector. (U. U.)

Rualena goleta Chamberlin and Ivie, new species

(Figs. 69–70)

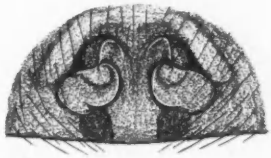
A light colored species of typical color pattern, and typical structure. The annuli on the legs are very faint. Minor differences in the palpus and epigynum distinguish it from other closely related species.

Measurements:	♂ Holotype	♀
Length	7.20 mm.	8.50 mm.
Carapace:		
Length	3.50	4.20
Width	2.45	2.85
Tibia-patella:		
I	4.30	3.90
IV	4.60	4.50

Type locality: W 119° 50′ : N 34° 28′, near Goleta, California; ♂ holotype, ♀ allotype, ♀ paratypes; July 12, 1934; W. Ivie and H. Rasmussen collectors; several ♀ paratypes, Sept. 16, 1941, W. Ivie collector. (U. U.)

EXPLANATION OF PLATE VIII

Melpomene coahuilana (Gertsch and Davis). 64. Epigynum. *Rualena cruzana* Chamberlin and Ivie, n. sp. 65. Left palpus, ventral view. 66. Epigynum. *Rualena cockerelli* Chamberlin and Ivie, n. sp. 67. Epigynum. *Rualena surana* Chamberlin and Ivie, n. sp. 68. Epigynum. *Rualena goleta* Chamberlin and Ivie, n. sp. 69. Left palpus, ventral view. 70. Epigynum. *Rualena avila* Chamberlin and Ivie, n. sp. 71. Epigynum. *Rualena alleni* Chamberlin and Ivie, n. sp. 72. Epigynum. *Rualena magnacava* Chamberlin and Ivie, n. sp. 73. Epigynum.



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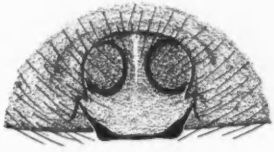

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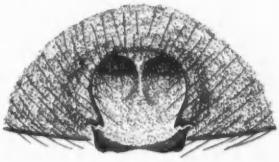

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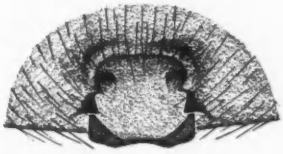

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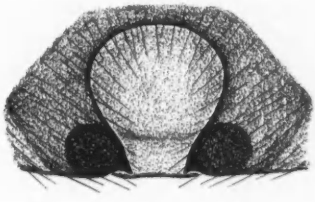

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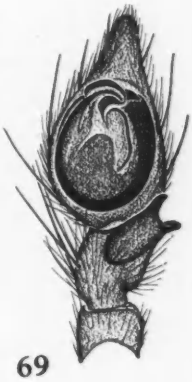

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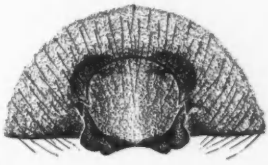

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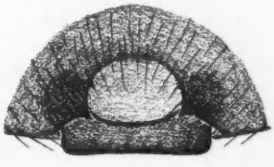

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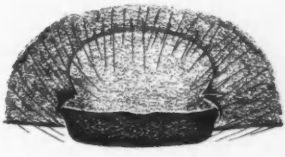

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Rualena avila Chamberlin and Ivie, new species
(Fig. 71)

Color typical. Epigynum with a heavy posterior ridge. Hind spinnerets short, with apical segment slightly shorter than basal.

Measurements:	♀ Holotype
Length	7.00 mm.
Carapace:	
Length	2.80
Width	2.00
Tibia-patella:	
I	2.65
IV	3.00

Type loaclity: About W 120° 40′ : N 35° 16′, San Luis Obispo, California; ♀ holotype; August 3, 1931; R. V. Chamberlin collector. (U. U.)

Rualena alleni Chamberlin and Ivie, new species
(Fig. 72)

Color typical; annuli fairly distinct on under sides of femora. Structure similar to that of *avila*, except for differences in the epigynum.

Measurements:	♀ Holotype
Length	9.50 mm.
Carapace:	
Length	4.40
Width	3.00
Tibia-patella:	
I	4.20
IV	5.00

Type locality: About W 119° 30′ : N 33° 15′, San Nicholas Island, California; ♀ holotype, ♀ paratype; July, 1938; Harry Allen collector. (A. M.)

Rualena magnacava Chamberlin and Ivie, new species
(Fig. 73)

Color essentially typical. Legs with distinct annuli on femora and tibiae. Abdomen with a median dusky lanceolate mark on basal part above. Epigynum with a large horse-shoe shaped depression. Hind spinnerets with the apical segment very slender and fully as long as the basal segment.

Measurements:	♀ Holotype
Length	7.00 mm.
Carapace:	
Length	2.95
Width	1.85
Tibia-patella:	
I	2.95
IV	3.65

Type locality: W 116° 8′ : N 32° 20′, Mountain Springs, California; ♀ holotype, ♀ paratype; January 8, 1941; Dorothea and Stanley Mulaik collectors. (U. U.)

Genus **Melpomene** Cambridge

Melpomene Cambridge, 1898, Biol. Centr. Amer., 1: 285.
Agelenopsis (in part), F. Cambridge, 1902, Ibid., 2: 336.
Agelena (in part), Petrunkevitch, 1911, Catalogue, p. 527.

Color variable; the following will be taken as typical, with variations from it noted under each species:

Carapace with a black marginal seam along each side of the thorax, above which is a wide whitish band, which may extend as far forward as the clypeus; a narrow median light band extending the full length above; the rest dusky brown, with blackish reticulations on the side of the head, and radial marks on the thorax. Chelicerae reddish brown. Labium and endites orange brown, with whitish tips; the labium shaded with dusky. Sternum orange, variously marked or shaded with dusky. Coxae of legs below orange, with the distal edge dusky. Legs brownish orange, more reddish distally; dark gray annuli usually present, but these are largely broken up into spots and blotches; a pale annulus distad of middle on femur, set off by dark gray, and a dusky annulus at base (the femur marked much as in *Novalena*). Abdomen dark gray above, lighter below; with a typical pattern above, consisting of a wide median band, containing a dark gray, broadly lanceolate mark on basal part, set off with pale broken lines, and a herring-bone pattern on distal half; lower sides mottled or spotted; ventral area dark gray, or light gray surrounded by dark gray. Spinnerets reddish brown, shaded with dusky.

Structure: Eyes all about equal; P. M. eyes about three-fourths of a diameter apart, only a radius from the side eyes. Chelicerae with four small teeth on the hind margin. Legs long and slender; tibia-patella I longer than carapace; spines small. Hind spinnerets with the terminal segment much longer than the basal segment, sometimes nearly twice as long.

Epigynum consists of a large cavity, divided by a broad median septum.

Palpus: Femur and patella unmodified. Tibia short, with the ectal side slightly sculptured, and with a short terminal process. Tarsus moderately large; cymbium thin, deeply concave, with distal end more or less extended. The palpal organs show considerable variation in detail. The tegulum is more or less extended into one or more chitinized processes. Embolus variously coiled or twisted, with the tip held by a well-developed fulcrum. Median apophysis small or absent. Conductor situated distally, well-developed.

Genotype: Melpomene elegans Cambridge.

This genus is readily distinguished from most others by the four teeth on the hind margin of the fang groove and the long terminal segment of the hind spinnerets. This genus is most nearly related to *Agelenopsis* and *Tortolena*.

Melpomene elegans Cambridge

Melpomene elegans Cambridge, 1898, Biol. Centr. Amer., 1: 285, Pl. 39, f. 6.
Agelenopsis elegans F Cambridge, 1902, Ibid., 2: 336, Pl. 31, f. 37.
Agelena elegans Petrunkevitch, 1911, Catalogue, p. 527.

Male. Length 11.25 mm. Color and structure evidently typical. The sternum has the central portion dark brown, with a pale yellow-brown spot in the middle, and the broad margins pale yellow-brown.

Type locality: W 99° 12′ : N 18° 55′, Cuernavaca, Morelos, Mexico; ♂ holotype; H. H. Smith collector. (Godman and Salvin collection.)

Melpomene bicavata (F. Cambridge)

(Figs. 74–76)

Agelenopsis bicavata F. Cambridge, 1902, Biol. Centr. Amer., 2: 337, Pl. 32, f. 4.
Agelena bicavata Petrunkevitch, 1911, Catalogue, p. 527.

Color: Carapace with a distinct narrow, light, median line, extending from the median ocular area to the base. Sternum dusky brown, with a yellowish median mark on the anterior half, and faintly darker radial marks. Venter of abdomen dark gray; lower sides spotted. Color otherwise essentially typical.

Structure in general typical, with a distinctive palpus and epigynum, as shown by the figures.

Measurements:	♂	♀
Length	7.70 mm.	9.10 mm.
Carapace:		
Length	3.50	3.75
Width	2.60	2.70
Tibia-patella:		
I	4.70	4.20
IV	5.00	4.65

Type locality: Omilteme, Guerrero, Mexico; ♀ holotype; H. H. Smith collector. (Godman and Salvin collection.)

Known Localities:

84.9 ♂ ♀—San Jose, Costa Rica. (A. M.)
♀ —(Type locality.)

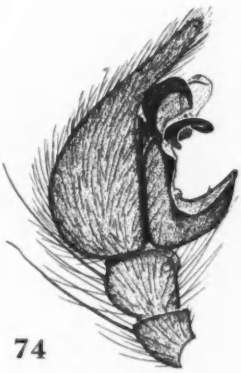
Melpomene plesia Chamberlin and Ivie, new species

(Fig. 77)

Color: Reticulations and radial marks of carapace distinct; median band indistinct; top of head back of eyes pale, with a dark mark on each side behind. Sternum broadly orange medially, gradually becoming dusky on lateral margins. Legs typical. Dorsum of abdomen typical;

EXPLANATION OF PLATE IX

Melpomene bicavata (F. Cambridge). 74. Left palpus, mesal view. 75. Left palpus, ventral view. 76. Epigynum. *Melpomene plesia* Chamberlin and Ivie, n. sp. 77. Epigynum. *Melpomene chiricana* Chamberlin and Ivie, n. sp. 78. Epigynum. *Melpomene singula* (Gertsch and Ivie). 79. Left palpus, ventral view. 80. Left palpus, ectal view.



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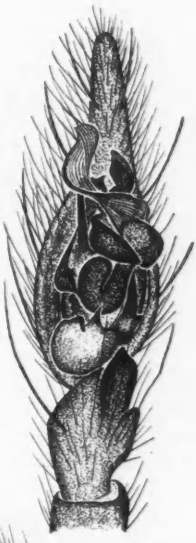

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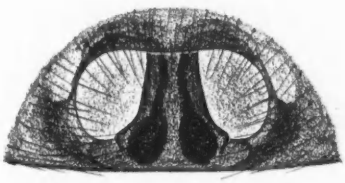

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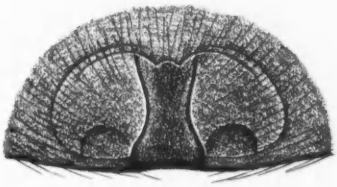

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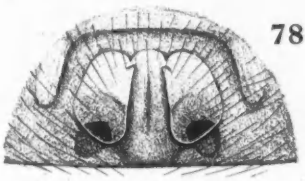

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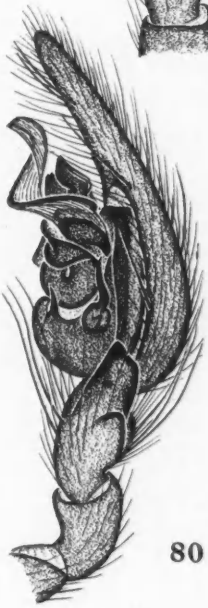

80

sides mottled, rather than spotted; venter pale in center, surrounded by dary gray.

Structure essentially typical; epigynum as figured.

Measurements:	♀ Holotype
Length	8.20 mm.
Carapace:	
Length	3.50
Width	2.55
Tibia-patella:	
I	4.35
IV	4.70

Type locality: El Volcan, Chiriqui Province, Panama; ♀ holotype, 2 ♀ paratypes; February 23, 1936; W. J. Gertsch collector. (A. M., ♀ U. U.)

Melpomene chiricana Chamberlin and Ivie, new species

(Fig. 78)

Color similar to that of *plesia*. Structure essentially typical. A. M. eyes slightly smaller than the others. Terminal segment of the hind spinnerets only a little longer than the basal segment.

Measurements:	♀ Holotype
Length	9.00 mm.
Carapace:	
Length	3.60
Width	2.60
Tibia-patella:	
I	4.10
IV	4.40

Type locality: Cerro Punta, Chiriqui, Panama: ♀ holotype; March 4, 1936; W. J. Gertsch collector. (A. M.)

Melpomene coahuilana (Gertsch and Davis)

(Fig. 64)

Agelena coahuilana Gertsch and Davis, 1941, Amer. Mus. Novitates, No. 1059: 2, f. 5.

Color essentially typical. Median band of carapace as wide as the eye area. Sternum dusky, somewhat paler in center. Legs strongly marked with dusky. Abdomen colored as in *plesia*.

The chelicerae has only three teeth on the hind margin of the fang groove. The epigynum is a distinctive type as shown by the figure.

Measurements:	♀ Holotype
Length	8.00 mm.
Carapace:	
Length	3.65
Width	2.30
Tibia-patella:	
I	3.65
IV	3.85

Type locality: W 100° 59′ : N 24° 40′, 5 mi. S. E. Saltillo, Mexico; ♀ holotype; November 26, 1937; A. M. and L. I. Davis collectors. (A. M.)

Known Localities:
100.24 ♀—(Type locality.)
101.22 ♀—W. San Luis Po tosi, Mexico; June 7, 1941; A. M. and L. I. Davis. (A. M.)

Melpomene panamana (Petrunkevitch)

Agelena panamana Petrunkevitch, 1925, Trans. Conn. Acad. Sci., 27: 161, f. 82.

Color and structure evidently typical.

Measurements:	♀
Length	10.00 mm.
Carapace:	
Length	4.6
Width	3.1
Tibia-patella:	
I	5.2
IV	5.5

Type locality: Wilcox Camp, San Lorenzo River, Panama; ♀ holotype; Bocas del Monte ♀ paratype. (Collection of A. Petrunkevitch.)

Melpomene singula (Gertsch and Ivie)
(Figs. 79–80)

Agelena singula Gertsch and Ivie, 1936, Amer. Mus. Novitates, No. 858: 23, ff. 49–50.

Color and structure in general typical. Leg I longer than Leg IV. Palpus elongate, structure as shown in the figures.

Measurements:	♂ Holotype
Length	7.50 mm.
Carapace:	
Length	3.70
Width	2.55
Tibia-patella:	
I	6.30
IV	5.80

Type locality: W 96° 54′ : N 18° 52′, Cordova, Mexico; ♂ holotype. (A. M.)

Melpomene transversa (F. Cambridge)

Agelenopsis transversa F. Cambridge, 1902, Biol. Centr. Amer., 2: 336, Pl. 31, f. 38.
Agelena transversa Petrunkevitch, 1911, Catalogue, p. 529.

Male. Length 7 mm. Carapace brown, with a large, pale patch behind the eyes and a marginal band. Abdomen brown, with a pale central band, dentated in the posterior half. Legs dull yellow-brown, the femora very faintly annulated with darker brown. (F. Cambridge.)

Type locality: Omilteme, Guerrero, Mexico; ♂ holotype; H. H. Smith collector. (Godman and Salvin collection.)

BOOK NOTICES

THE NATURALISTS' DIRECTORY, 32ND EDITION, 1940, 292 pages plus advertising pages, paper bound. Published by THE CASSINO PRESS, Salem, Mass. Price, $3.00.

For the general collector this is one of the most useful books of which we know. With the death of its originator we had feared that it would be discontinued, but the demand was so urgent that with its established place in American natural history it has been kept going by Samuel Cassino's successors. It lists American naturalists by states and provinces (Canada) with those of other countries under their country's name. Each name is followed by the correct postal address and the person's interests. It gives a list of scientific periodicals and one of natural history museums. In its advertising pages it advertises foreign collectors and dealers. It lists about 6,000 naturalists, mostly American and Canadian.

The next edition (33rd) will appear in December, 1942.—C. H. K.

OUR SHADE TREES, by EPHRAIM PORTER FELT. Pages 1-320. 1941. 5½ x 8 inches. Published by the ORANGE JUDD PUBLISHING COMPANY, Inc., New York. Price, $2.00.

The purpose of this book is "to outline the relation of trees to suburban life, the needs of shade trees under prevailing conditions and to advise methods which will permit the owner to offset . . . the present day perils or hazards of shade trees."

In this revised and enlarged edition are incorporated the more important lessons of the 1938 hurricane, particularly those relating to growing trees to make them more resistant to storms. The discussion of windstorms has been largely rewritten and considerably amplified. The method of appraising storm damage to trees, which is amplified in this edition, seems a very satisfactory way of estimating tree losses and their effect on real estate values.

The table of contents is indicative of the scope of the book: I. Shade Trees and Men. II. General Shade Tree Care. III. The Language of Shade Trees. IV. The Troubles of Shade Trees. V. The Selection and Planting of Shade Trees. VI. Research and Education. VII. Control of Insects and Diseases. VIII. A List of Some of the More Useful Books on Trees and Shrubs.

This account of shade trees is clear, comprehensive, and up-to-date; it will be of interest to anyone interested in trees, and of considerable practical value to tree owners, tree wardens, city foresters, and others interested in the planting and management of shade trees. Its author, the Director of the Bartlett Tree Research Laboratories, has had over 40 years of experience with the problems of which he writes. The book is printed with large clear type on a good grade of paper, and contains 47 full-page half-tone plates.—D. J. BORROR.

BEETLES OF THE GENUS HYPERASPIS INHABITING THE UNITED STATES, by TH. DOBZHANSKY, Smithsonian Misc. Coll., Vol. 101, No. 6, 92 pages, 6 pls. Published by the SMITHSONIAN INSTITUTION with funds from the THOMAS LINCOLN CASEY FUND. Washington, D. C.

After his remarkable studies of the genetics of the species of Drosophila and particularly his studies of species wild and in the field, the author probably has a better concept of natural species than has the average collector or museum expert. Any monographic revision from his pen should reflect such experience. He had use of the material in about ten of the large collections of the United States.

In the plates he gives color patterns of our Two-spotted Lady Bird Beetle and its numerous relatives, also outlines of penes of the males. It is the type of illustrated monograph that helps students and collectors clear down to freshmen.

Dobzhansky is Russian by birth, a graduate of the University of Kief, a past lecturer in the University of Leningrad and from 1929 to about 1940 on the staff of the California Institute of Technology where he taught genetics. He is now

on the staff of the Department of Zoology at Columbia University. His immediate reputation rests on his volume, "Genetics and the Origin of Species," published by the Columbia University Press in 1937. His basic interest and training in Russia was as an entomologist. We claim that he is still one of our very prominent entomologists.—C. H. K.

SUPPLEMENT TO INSECTS OF NORTH CAROLINA, by C. S. BRIMLEY, L. L. D. Pages 1–39. 1942. Paper bound. Published by the Division of Entomology, North Carolina Department of Agriculture.

On page 647, vol. 31 of these Annals for 1938, we gave a notice of "Insects of North Carolina," (price $2.00), Dr. C. S. Brimley of the North Carolina State Department of Agriculture. "The number of species in the different orders now stands as follows: Insects 10,401, Near-Insects or Forms Allied to Insects, 690; a grand total of 11,091 on December 31, 1941."

We have found this work and "The Insects of New York" very handy in editorial work where we use them to check the spelling of scientific names the Latin of which does not "sound quite right." They have also been used to the point of showing wear in checking distribution of species. While mere lists they are curiously useful works in times of real need. With Webster's Dictionary and "A Glossary of Entomology" by Torre-Bueno they stand within easy reach of our desk.—C. H. K.

PAPÉIS A VULSOS DO DEPARTAMENTO DE ZOOLOGIA, SECRETARIA DA AGRICULTURA, INDUSTRIA E COMERCIO, Estado Sao Paulo, Brasil. Vol. I, pp. i-vii and 1-273, illustrated. 1941.

We wish to call attention to this excellent biological journal recently established by the state of Sao Paulo, Brazil. It is of particular interest to entomologists because it carries many articles on the insect fauna of that area. Of the twenty-eight articles, eighteen are on new forms of insects, while four are on arachnids. The remaining articles are on mammals, 4, fish, 1, and worms, 1. The text and scientific descriptions are in Portuguese.

Few persons realize the extent of biological research in Brazil. Over seventy journals published in that area carry biological articles. The Editor of these Annals has made it a point to obtain material on the South American insect fauna in order to make the Annals useful to the many South American institutions who could subscribe to our journal. Our subscription list lost few items during the recent hard times. We are preparing for future difficulties.—C. H. K.

THE LIFE OF LANGSTROTH, AMERICA'S MASTER OF BEE CULTURE by FLORENCE NAILE, pages 1–215, 2 figs. and portrait. 1942. 5½ x 9 inches. Linen bound. Published by the CORNELL UNIVERSITY PRESS, Ithaca, N. Y. Price, $2.50.

Seldom have we enjoyed giving credit as much as we enjoy giving it now, not only to the author of the present volume but to Langstroth himself. Here was a man, a minister of the Gospel by education, who never called himself an entomologist but, who, through a study of the management of bees during the middle and latter part of a very long life, probably showed the way to more world profits than has any other student of insects. Langstroth was the inventor of the modern bee hive used now throughout the world wherever beekeeping has been put on a scientific basis. His studies have given civilization quantity honey production and indirectly have provided the means of the fertilization of the world's deciduous fruit. Without the quantity cultivation of the honeybee our great orchard and berry regions would produce only meagre crops.

Author Naile has an easy flowing style which completely submerges her composition in the running array of interesting facts concerning the activities of this unusual man. She has treated his life under the chapter headings:

I. Parentage and Boyhood. Langstroth was of English stock born in 1810 and reared in Philadelphia, his father a paper manufacturer. II. Student and Tutor at Yale. After graduation in 1831, educated for the ministry and elected to Phi

Beta Kappa, he taught and tutored for five years. III. Minister and Schoolmaster. In 1836 Langstroth was called to the South Church in Andover, Mass. While here he married Anne Tucker, the daughter of a mistress of a girls' school. Though successful in his chosen profession at the end of two years he resigned on account of an attack of poor health and taught in a local academy. In 1840 he moved to Greenfield, Mass., as principal of a girls' school where he also preached in the local church until 1848 when he again resigned because of poor health. IV. Observant Keeper of Bees. That same year he moved to Philadelphia. He had become interested in bees while at Andover and then and later in Philadelphia purchased several works on bees while also contacting any one interested in their rearing. He tried the various European forms of the bar hive which however did not solve the basic problem of combs glued to the top and sides of the hive. V. Discovery and Invention. In 1851 he discovered the use of a *bee space* of three-eighths of an inch above the bars which prevented the gluing of bars to the cover. That fall he devised the hanging spaced frame with a similar *bee space* between frames and between walls and frame ends. VI. Author and Journalist. In 1853 by financial aid of friends he published "Langstroth on the Hive and the Honey-Bee, a Bee Keepers Manual," 384 pages, which still is the classic of all classics in apiculture. VII. A New Era in Beekeeping. This is on his patent rights and the superior features of the movable frame hive. VIII. The Golden Bee Imported. The difficulties of, but final success in the importation of the tamer and more productive Italian bee. IX. Not to the Swift. Here are his difficulties in control of patent rights. X. A Chapter of Difficulties. We learn of his recurrent poor health of a nervous nature, his attempts to return to the ministry and a few words on his three remarkably helpful and generous brothers-in-law. XI. The Latter Years. His life at Oxford, Ohio, after the death of his wife, alternate periods of depression and poor health and of active work. XII. Estimate and Eulogy. A chapter on friends and admirers.

Three great accomplishments stand out in Langstroth's life. He invented the Langstroth hive based on a detailed study of bee habits, a hive in universal use in all enlightened areas today. He published "Langstroth on the Hive and the Honey-Bee" the first scientific work on apiculture, one that was translated into many languages. He made lasting and strong friendships all through life, ties with his relatives and with men of influence and ability who willingly saw him through his almost continuous financial difficulties brought on because of the recurrent periods of poor health.

Langstroth died on Sunday, October 6, 1895, in the pulpit of the Wayne Avenue United Presbyterian Church at Dayton, Ohio. He rests in Woodlawn Cemetery at Dayton under the inscription, "Father of American Beekeeping."

This volume is a must for all men who devote *their* lives to the painstaking study of insect life.—C. H. K.

BIRD PORTRAITS IN COLOR, Text by THOMAS SADLER ROBERTS. 90 plates in color of 295 North American Species. 8½ x 11¼ inches. Published by THE UNIVERSITY OF MINNESOTA PRESS, University of Minnesota, Minneapolis, Minn. Price, $3.50.

We quote from the Introduction: "Ever since the publication of 'The Birds of Minnesota,' some years ago, there has been a steady and growing demand for the plates illustrating that work, in a more convenient form. The larger work (two volumes) is too bulky and heavy to be carried afield or to meet all the requirements of the schoolroom and the casual bird lover. The text accompanying the plates is largely new and only here and there has matter from the earlier work been used directly."

The volume is a series of colored plates. On the back of each plate is text explanatory of the succeeding (facing) plate. This text is by Professor Roberts. The lovely plates are by various nationally known bird artists. One plate, No. 23, of flying quail, is by Louis Agassiz Fuertes. Thirty-six plates are by Allan Brooks among which those of the blue birds and robins, the thrushes and the kinglets show his work at its best. The twelve plates of sparrows and their relatives are by Walter Alois Weber. These are in a different, a harder type of drawing fitted best to such patterns as those of the bobolink and meadow lark.

A few plates are included which are drawn by Francis Lee Jacques and by Walter John Breckenridge. Perhaps the loveliest of all are those by George Miksch Sutton who figures the grouse, kingbirds, flycatchers and the vireos.

For those interested in the problems of bird illustration "Bird Portraits in Color" shows the specialized drawing used in this field and the differing techniques used by recent and present-day artists. In this branch of illustration shadows are minimized to avoid obscuring the details of color pattern. To obtain balance in design and to level out the brilliant and contrasting colors of the birds the artist has to resort to almost prismatic colors in the background. The clashes in color have to be offset by properly placed complimentary colors of slightly less intensity. A bird plate raises very intricate color-design problems. Only a few artists after long years of study and with a natural flair for associating colors ever really succeed in this field of illustration. If the student will compare Sutton's work with that of Audubon of a century earlier, one of the first to attack the problems, he will see the advances that have been made. Audubon came into the work from the school of human portraiture of his day where poses and facial expression were the essence of good art. Shadows were used for balance and design and bird colors had to be minimized to agree with such elements of composition. In those days of less expensive reproduction Audubon's birds were live things that strutted their stuff across a whole plate to one species. In our day of high art costs and concessions to the conveniences of condensation the birds have to be calm and in repose to get several species onto one plate. A hasty tempered bird in a modern plate would upset everything.

After feeding sunflower seeds to our backyard bedraggled redbirds and digging worms for John Q. and Mrs. Robin who are smudged from head to foot with win-the-war Columbus soot we wonder where the artists found the sprightly spick-and-span birds which are drawn in this book. We wonder how a bird lover can keep his mind even on birds when these disport themselves on azure lakes that shade into opalescent sky; and then the perfect sanitation where waterfowl congregate. Oh, for one dead fish and a bucket of mud! But this volume is a bird book set apart from the low keyed actualities of the environment. It is a jewel of lovely colors.

The text is without keys, descriptions or technicalities other than the insertion in Italics of the scientific name after each common name. In a running account it gives distribution of each species and a few sentences on habits or other matters of interest. "Bird Portraits in Color" is the greatest value we have seen in beauty and practical information for the very modest price of three and a half dollars. We are thrilled when we turn the pages in such a book. It becomes difficult to take our mind off the pictures long enough to set down our impressions.

—C. H. K.

COLLEGE ENTOMOLOGY, by E. O. Essig. Pages vii and 900, 308 figs. and map. 1942. Size 7½ x 6½ x 2 inches. Published by The Macmillan Company, 60 Fifth Avenue, New York. Price $5.00.

This excellent volume is one on the advanced taxonomy of insects, thirty-three chapters on orders and only three introductory or orienting chapters. The latter are: I. Metamorphosis of Insects; II. Anatomy of Insects; and III. Classification of Insects. Essig is distinctly visual minded, an artist and morphologist as is shown by the elegant illustrations of his technical papers and his national rating as a breeder of the lovely Iris. Throughout, the volume emphasizes morphology and gives physiology a second place. While such a presentation will not satisfy the physiologists and will limit the use of the book as a general text, it is as it should be. The volume is avowedly taxonomic, and, in spite of its broad title, taxonomy in its present development is based almost wholly on morphology. Few are well prepared mentally to write such a volume. We have always marvelled at Essig's ability and persistent drive.

While the title may have been a compromise with the publishers because of its sales value, an editor would have used one that was more precise. For several years we have been experiencing the need of such a review of insect taxonomy as our recent American texts have sadly lagged behind the knowledge of the advanced specialists. Because the preceding necessary steps in the evolution of taxonomic

theory have already appeared and have been critically studied we have been ready for some years for a summation and expansion of their facts. Essig's work is the first American attempt to fill that gap with an adequately expanded and adequately illustrated text book.

The modern classification of insects was set up as a whole for the first time by Brauer, 1885. In 1898, 1899, Comstock and Needham published the system of wing vein nomenclature that bears their names and which for the first time was based directly on evolutionary data. This gave a great tool into the hands of taxonomists. In 1906–1908 Handlirsch applied the Comstock-Needham system of terms throughout his monumental work, "Die Fossilen Insekten," thus showing the Brauer and Comstock-Needham systems to be consistent with the fossil record. The Comstock texts carried the system as developed up to this point and used the Handlirsch ordinal terms as far as was compatible at that time with college text presentation. In Schröder, Handbuch der Entomologie, vol. III, 1928, Handlirsch again brought the system down to date. In 1915 Melander and Brues published "Keys to the Families of North American Insects" which followed the Handlirsch system and later, 1932, expanded this publication into a well illustrated volume of keys to cover the World fauna. In 1924 Imms gave us the first edition of his British Empire text which in that and later editions covered the World fauna but dropped back to a list of 23 orders. Thus had been built up our present system of taxonomy which is used by all specialists who have to do with the description and evolutionary arrangement of insect orders. Essig uses thirty-three orders which brings his volume down to date. Thus the material and times were ripe for the Essig book.

While physiology is given minor mention in the volume the author has brought together for the first time a great body of facts on habits and life histories. These paragraphs under each family caption make the volume interesting to the student and save it as a general text. We have enjoyed browsing through the volume and adding to our knowledge facts concerning many strange families, facts which frequently have become known only since the recent world wide education of experts in our science.

Our criticism of this otherwise excellent volume is that highly technical parts on orders with which the author had had little personal experience were not read in manuscript and criticized by carefully chosen experts. As everyone knows the literature on any order contains many and even pretentious publications of recent date that may be sadly out of date as to family placements, characterizations, keys, etc. The writer of a comprehensive text cannot always spot such. As an example the Comstock-Needham system as used for the Odonata has been shown by Tillyard, Martynov and Carpenter to be in error. Yet it is used in spots in this text.

The reviewer will have to admit here that he still uses it for its convenience to himself and other Odonatists who know the system and some of whom may not be familiar with the corrections recently introduced. But we are not publishing advanced texts. We do feel a twinge of shame every time we use this system. In this volume Essig uses the advanced system in fig. 82 for Lestes, but the earlier system in fig. 8 Aeschna (which should be Aeshna) and in fig. 85, Libellula with no caution to the reader that he switches from one to the other. In fig. 82 MA is "Media A" and not the medio-anal link as stated in the legend. The link is at the apex of the triangle. The key to Aeschnoidea, pp. 240, 241, uses the terms of the Tillyard system but the figure illustrating these terms is labelled under the Comstock-Needham system. As an Editor we are annoyed by page 246. This is four-fifths blank, which space could have carried references to the recent sound papers, mostly on paleontology, on the evolution and venation of Odonata. A writer covering a broad field needs expert friends; Essig has numerous such friends but has not used their expert advice.

The author has done one outstanding thing: he has had the courage to publish a much needed volume. From here on it will be only a problem of correcting details many of which any editor will acknowledge are not easily recognized until the matter is in print. The numerous illustrations are excellent. The matter is well chosen and arranged and written in an easy, flowing style. The styles of type are well chosen, lines spaced for easy reading and the paper and linen binding are of the best.—C. H. K.

INSECTS AND THEIR WAYS, by BERTHA MORRIS PARKER, illustrated by Elizabeth Newhall. Pages 1–36, 48 figures in color. Size 10½ x 8½ inches. 1942. Published by HARPER AND BROTHERS, 49 East 33rd Street, New York. Price $1.00.

Insects and their Ways is a child's introduction to the marvels of insect life. Its attractiveness lies in the many beautiful water colors which, drawn with few shadows, give an effect somewhat of the older shadowless Japanese block prints. In general it presents sound information of insect life histories and habits while the lovely pictures display the forms and colors. The book is excellent from an informative point of view in that each insect is presented in all its life forms, egg, larva, pupa and adult. In it an insect is always an insect as there is no anthropomorphic phraseology that suggests thought or intention on the part of individual insects. The life histories are of the cecropia moth, monarch butterfly, grasshopper, dragonfly, mosquito, mantis, bumblebee, back swimmer, ant lion, seventeen-year locust, aphid, ladybird and firefly. The final third of the volume outlines "Where insects live," Life histories, What insects eat, How insects protect themselves, Friends and enemies, and finally a few summary words, "Looking back." We like the book. It is a gorgeous effort to give the child a correct idea of the nature and habits of the more common insects.

Some curious very minor errors have crept into it, but nothing that should misinform a child seriously. The ant is chosen as illustrative of the division of the body into head, thorax and abdomen. Unfortunately in the higher Hymenoptera the fourth segment of the thorax is really the first segment of the abdomen. On page 6 the cecropia moth finds a little door in its cocoon through which it escapes. But this door is only in the outer shell. The moth dissolves the tough silk of the inner layer with KOH. On page 9 the grasshopper "shoots tobacco juice at you." We have never seen it actually shot. On pages 10 and 11 in the life history of the dragonfly the nymphs of the first three stages are libelluline and practically full grown. The last nymph and skin and adult are Aeshnine. On page 16 the drone (male) bumblebee has female antennae. But why point out such items? We could not do as well. We recommend the book highly as a very attractive and honest introduction of the child to the wonders of the insect world. The author, artist and publisher are to be commended for their really successful effort to get away from the fairy tale type of juvenile literature. A book can be very attractive and interesting as this is without a teleological or anthropomorphic phrase. Obviously such juvenile books as Insects and their Ways are indicative of the high standards strived for by the better authors and publishers.—C. H. K.

PRAIRIE DOG TOWN, by MARGARET T. RAYMOND AND CARL MOHR. 56 pages, 38 illustrations (14 full page). 1942. 6¾ x 9 inches. Published by DODD, MEAD AND COMPANY, 443–449 Fourth Avenue, New York. Price $1.50.

Prairie dog towns of the vast western plains have always interested the traveler. The dense population within a limited area attracts the eye, while semisocial behavior in the town appeals to the member of the human species who in his innermost spirit yearns for a happy life in a comfortable social setting. Between radio news briefs he may even wonder whether the prairie dog may not have beaten him to such an ideal existence.

Prairie Dog Town was written for the young mind to whom the world is still fresh and new. However, it is so replete with vivid incidents of prairie dog life that its story is equally interesting to the adult reader. The little volume is the product of a trained and experienced writer of juvenile stories and of an artist-naturalist, an entomologist by profession. The paper jacket states that "Margaret T. Raymond has red hair, green eyes and freckles," a combination of physical characters that one associates with a perennially youthful point of view. She is a widely recognized authority in the field of juvenile literature. Doctor Carl O. Mohr of the entomological staff of the Illinois State Natural History Survey is a mammalogist and artist by avocation. It was he who studied prairie dog towns and who prepared the pen sketches and data on which the story of prairie dog life is based. The remarkable photographs, truly personal portraits, of prairie dogs are the work of J. W. Jackson, a Colorado photographer of wild life.

who used a specially built camera that could be operated from an automobile as a blind. The double-page photograph of five "Baby Prairie Dogs" is one of the most fascinating wild life pictures we have seen. It will rate as a classic in the field of animal portraits.

Prairie Dog Town is not in conventional chapters or even with captions. The text is built around the series of descriptive illustrations. The tale starts one February with the spring awakening from hibernation of a mother prairie dog and traces the experiences of the parents and their brood through the summer, through the following winter hibernation and ends with some incidents of courtship of a son and the daughter of a neighboring family the second spring. Woven into this interesting story are experiences with prairie dog friends and enemies, the burrowing owls, hawks, rattle-snakes, ferrets, rabbits, badgers, wolves and even the prong-horn antelope.

In our own search for good juvenile natural history we have given Prairie Dog Town AAA1 rating.—C. H. K.

I. THE CLASSIFICATION OF THE GENUS DROSOPHILA, ETC., by A. H. STURTEVANT, Calif. Inst. Tech. Pages 1–51.

II. NEW SPECIES OF THE QUINARIA GROUP IN THE SUBGENUS DROSOPHILA, by W. P. SPENCER, Wooster College. Pages 53–66.

III. NEW SPECIES OF THE SUBGENERA HIRTODROSOPHILA AND DROSOPHILA, by J. T. PATTERSON AND M. R. WHEELER, University of Texas. Pages 67–109. THE UNIVERSITY OF TEXAS PUBLICATION, No. 4213, April 1, 1942; pp. 1–109. Paper Bound. University of Texas, Austin, Texas. Price $1.00.

In this publication fifty-two new wild species of Drosophila are described. After twenty-five or more years of the laboratory study of Drosophila mutants reared in bottles various geneticists are exploring the wilds in a study of the species of that genus as they occur in nature. The problem of natural species-formation is being attacked directly. We call the attention of entomologists in general to the work of this group of entomologists who prefer to be called geneticists. The three contributions are straight taxonomy but are advanced taxonomy in that they include notes on internal anatomy. Other taxonomists might well study this publication because of its advanced ideas as to what constitutes a useful description.—C. H. K.

SYSTEMA APHIDIDAE. A GUIDE TO THE PHYLOGENY OF THE APHIDS OR PLANT LICE. Part One, THE LACHNEA. By O. W. OESTLUND. Pages i-v and 1-78. 6 x 9 inches, cartridge paper cover. Published by the AUGUSTANA BOOK CONCERN, Rock Island, Ill. Price $0.60.

This is the result of a lifetime devoted to an attempt to work out a logical system by which aphids can be classified into the many categories from family to subspecies. Because of the several forms in each species and the involved life histories the description of a species of aphid has become one of the very complex and highly conventionalized descriptions used in insect taxonomy. The present work is a philosopher's attempt to put some order into a system which has arisen by small accretions and constant rearrangement. Whether the author has succeeded in giving taxonomists a better system will have to be found out by trying out the Oestlund system on problems of aphid taxonomy under any and all conditions.

The author sets up a series of eight terms for known characters in aphids and aphid life histories so these do not need to be repeatedly described. By combinations of these expressions he erects "a key to the relative position of the various categories in the family higher than genus and species. All possible combinations (of these expressions) give 16 stages in the evolution of the category considered." This scheme has always taken the reviewer's eye. Once we erected such a scheme of combining characters to describe a series of species in the genus Agrion (Odonata). We found one combination missing. It was described a few years

later from southwestern Asia. But we had not prophesied by publication! The present work in genetics suggests the possibility of the use of such schemes in group analyses. Probably those entomologists who call themselves geneticists will beat us to its use.

Whether we like it or not things are changing in the methods used by taxonomists. Describers of parasitic Hymenoptera demand a statement of the host animal or in cynipids, the host plant and in the latter case a description of the gall. On another page we "notice" a work on new species of Drosophila where internal parts are described. All students of social insects recognize areas where the habits of some wide-spread morphological species differ markedly from the habits of the species in the type locality. Social insects have evolved farther in habits, physiologically, than they have evolved morphologically. Thus such physiological variants are good "physiological species." But try to give a species name to such social groups without citing some minute difference in color or nature of vestiture. The first museum reviewer will throw it into synonymy because of his ignorance of the positive live differences. However we have come face to face with such problems. The students of aphids are as squarely up against the problem as are the students of social and parasitic insects. Thus in taxonomy physiology is making its impression on old-line museum morphology. How soon these changes will be recognized, if ever, by international committees on nomenclature no one can say.

The reviewer does not have a sufficient knowledge of aphid taxonomy nor sufficient space to analyze the Oestlund system. However, he advises all addicts of taxonomy to acquire a copy and study its methods of attack on the problems involved. It is worth considerable study. We do not like the displacement of tried terms such as "genotype" by the term "nucleus" or the use of "epoch" for a series of related genera. Such unnecessary innovations can only prejudice the entomological student against the use of the system's good elements. Philosophers and reformers still get short shift in this barbaric world.

We recommend the book for painstaking and thoughtful study. It is a bold and logical effort in a difficult field.—C. H. K.

COTTON INSECTS OF THE UNITED STATES, by V. A. Little and D. F. Martin. ii×130 pages; 12 illustrations. 1942. Burgess Publishing Company, Minneapolis, Minn. Price, $2.25.

The authors are to be complimented on bringing together in one volume and presenting in a well-organized manner the widely scattered information on this important group of insects in the United States.

The book is divided into two parts, the first being the insects attacking squares, blooms and bolls; and the second on the pests of foliage, stems and roots. Detailed information on each pest or group of pests is presented in the following manner: Economic Importance; Origin, History, and Present Distribution; Food Plants; Description of Life Stages; Life History; Control Measures, Natural and Applied; Literature Cited. Deviation from the above is followed for the less important pests.

The book is neatly printed by the offset process and is illustrated by twelve figures taken from experiment station or U.S.D.A. publications. A table of contents precedes the information section and an index is appended.

The book will be an invaluable aid to teachers of entomology, and the agricultural workers on research and extension staffs of the state and federal governments. Publications of this kind should be encouraged.—R. H. D.

GENERAL ENTOMOLOGY, by S. W. Frost. Pages x and 524, 406 figures. 1942. Size 6¼ x 9¼ inches. Published by McGraw-Hill Book Company, Inc., 330 West 42nd St., New York. Price $4.00.

This volume is by one whose life has been devoted to study of the habits of insects. Frost has not been particularly interested in collecting endless exact (?) data while the frightened insect scrambled through a maze, nor has he observed with cool unbiased mind the drunken activities of insects in a super-

heated chamber or in the last throes of death while suffering from some carefully applied poison. Exact data! While reading "General Entomology" the term "exact data" recedes into the background of the reader's mind and he wanders contentedly through the many pages on the interesting things that insects do when they feel free to do just as they please. It is a volume from Fabre's point of view. (Curiously enough, Fabre's reputation as a great entomologist persists though he never attempted to express his reputation in a mathematical formula.)

It is an interesting comfortable book where the reader never hesitates to turn the next page for fear that he may meet a formula that is 2^n times his mathematical ability. (In spite of all which comfort in entomology we advise our students to have at least one year in the calculus to comprehend the variables in insect structure and conduct.)

The material is organized in twenty-three chapters: I. Position of Insects in the Animal World; II. Origin and Distribution of Insects; III. Abundance, Size and Reproductive Capacity; IV. Beneficial and Injurious Insects; V. Orders of Insects; VI. Metamorphosis; VII. Immature Insects; VIII. Morphology; IX. Color; X. Sonification; XI. Behavior; XII. Associations, Including Social Insects; XIII. Solitary Insects; XIV. Scavangers, Predators and Parasites; XV. Plants and Insects; XVI. Leaf-mining Insects; XVII. Leaf-rolling Insects; XVIII. Gall Insects; XIX. Boring Insects; XX. Subterranean Insects; XXI. Aquatic Insects; XXII. Case-making Insects; XXIII. Cessation of Activity.

The illustrations are well chosen and many are from the author's earlier volumes on the habits of insects. We do miss those very excellent illustrations of the C. V. Riley reports which have come down in entomological books to near recent times. Perhaps entomological illustration has at last turned a corner.

General Entomology is a volume that organizes a great mass of data that will be of much use to entomologists and particularly to teachers. For once we have a volume on the behavior of insects which is scientific and to be so is not three-fourths on aquatic forms. Following each chapter is a bibliography of one to six pages which makes the work an effective key to the literature. How many times we have wished for such in our own teaching of the biology of insects.

This is a volume that every working entomologist could read with benefit. It would review for him the whole field of insect activities and might suggest answers for some of the gaps in his own results when acquiring such knowledge by laborious research.

General Entomology is one of the "McGraw-Hill Publications in the Zoological Sciences." Thus it rates as one of a series of outstanding works in biology. It has the sturdy binding, excellent type face, and fine paper of this series.—C. H. K.

A LOT OF INSECTS, by FRANK E. LUTZ. Pages 1–304, 80 illustrations. 1941. Published by G. P. PUTNAM'S SONS, 2 West 45th St., New York. Price, $3.00.

The Annals gave a notice of "A Lot of Insects" (p. 772) in the December, 1941, issue. Its price quoted from the earliest advertising circular was given as $3.50. A letter from the author points out that the volume was actually published at $3.00. As this was our first experience with such a preliminary reduction the Editor was caught asleep when the three dollar notice arrived, probably in the early afternoon mail.—C. H. K.